WARNING

Because of possible shock or fire hazards, connection of this instrument should be performed in compliance with the National Electrical Code (ANSI C1) and/or any other requirements which may be applicable to the user.

Installation, operation, and maintenance should be performed only by qualified personnel.

TM-110300

SERVICE MANUAL
VOLUME 2

SERIES 808
ELECTRIC POWER
DEMAND ANALYZER

1 November 1983

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1 INTRODUCTION

This volume contains Maintainance Instructions for the Series 808 Electric Power/Demand Analyzer. For operating instructions relative to the Mainframe, refer to Volume 1 of this manual. Included in the following pages are the Theory of Operation, a Replaceable Parts List, Schematic Diagrams and Parts Location Drawings.

2 MAINFRAME BLOCK DIAGRAM

The 808 Unit System may be broken up into smaller blocks as shown in Figure 2-1. Each of these blocks performs a necessary function for the 808 to operate. The A2 Block, the Main Processor Board operates and co-ordinates the different blocks. This block also stores accumulated data and provides the necessary power supplies to run the unit.

The Printer, (the A5 Block), is operated by data sent from the A2 Block. The data received determines what is printed and how the paper is moved.

Data can also be sent to or from the A2 Block to the Keyboard/Display, (Block A1). The data sent to the A1 Block controls what is to be displayed, the Audio Alarm Status (ON or OFF), and which LED is to be on. Data sent from the keyboard tells the Main Processor A2 which key the user pressed.

Both the Battery BT1 and the Transformer Board A4 provide necessary assistance to the Main Processor Block A2. The A4 Block provides a low level AC voltage to run the battery charger of the A2 Block, whereas BT1 receives charging current from the A2 power section and provides the supplies of the Main Processor with necessary voltage and current.

The Final Block, the Analog Board A3, provides the Main Processor A2 with a continual update of monitored parameters, be it from analog or pulse inputs.

3 KEYBOARD/DISPLAY A1

The Keyboard/Display enables communication between the 808 user and the Main Processor Board. More specifically the board prompts LED lights, displays information and data requested by the user.

3.1 BLOCK DIAGRAM

The Main Processor Board controls the keyboard by the connections made through J1 on the keyboard, Figure 3-1. The Data and Address Bits needed for the operation of the board comes over the pin connections.

The different sections of the keyboard are selected by use of a 4 bit code applied to the Decoder U25. These address bits are labeled AØ, A1, A2, and SEL. The SEL signal must go low before any part of this board can be accessed by the Main Processor. Once the board is selected, the 3 address bits determine which of the following is to be addressed:

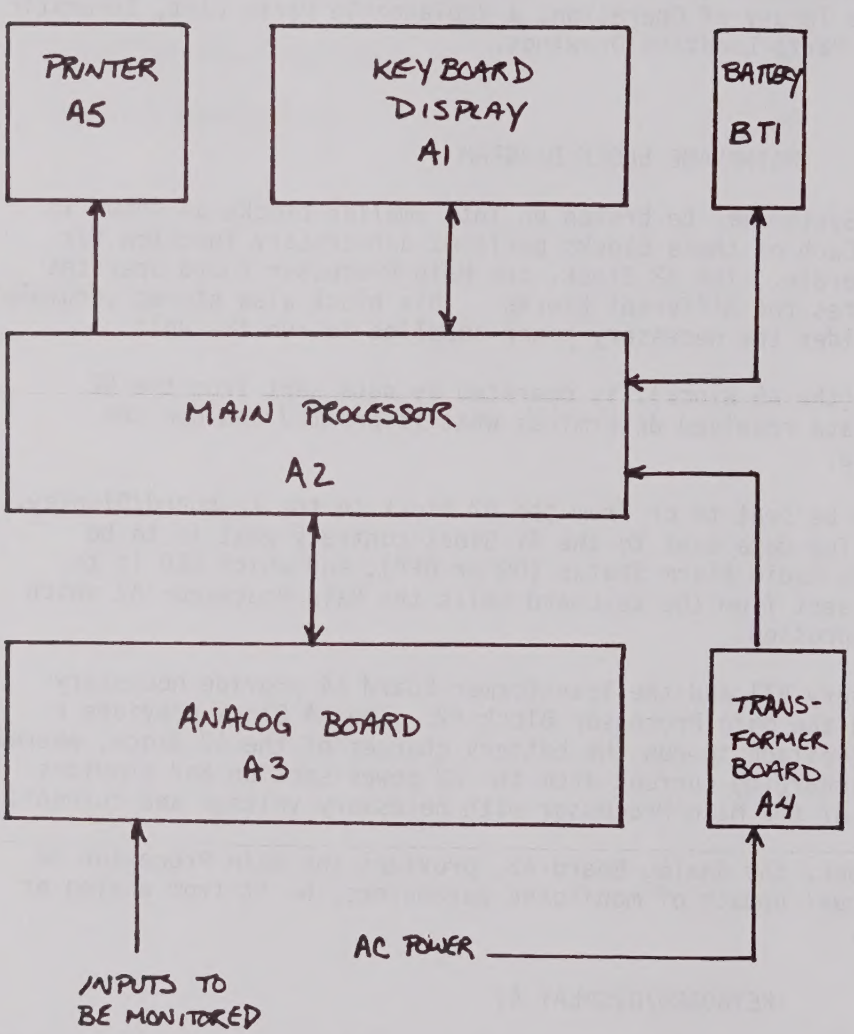


FIGURE 2-1 808 BLOCK DIAGRAM

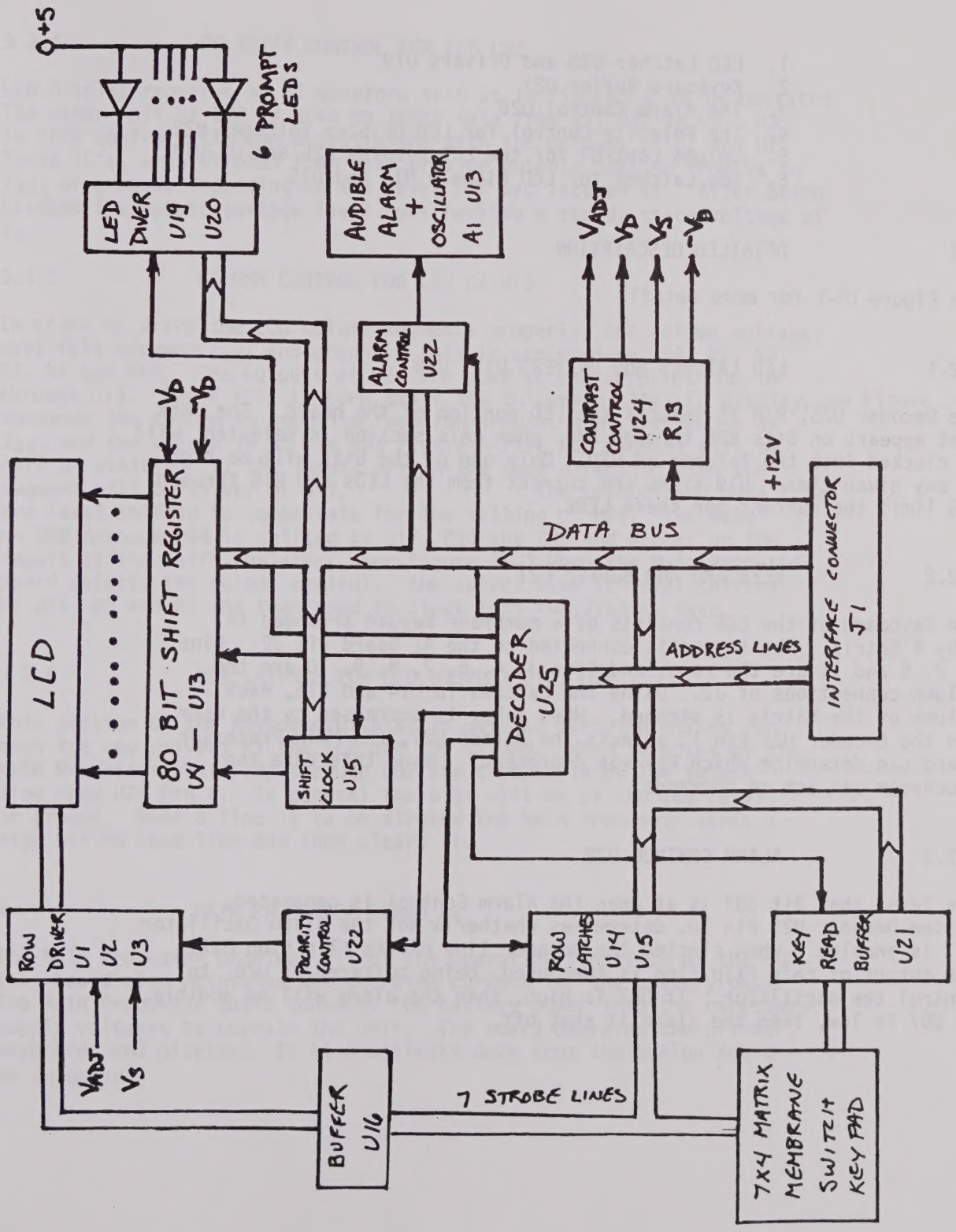


FIGURE 3-1 KEYBOARD/DISPLAY BLOCK DIAGRAM

1. LED Latches U20 and Drivers U19
2. Keyboard Buffer U21
3. The Alarm Control U26
4. The Polarity Control for LCD Display Voltages U22
5. Column Control for the LCD Display U26 and U4-U13
6. Row Latches for LCD Dispaly U14 and U15

3.2 DETAILED DESCRIPTION

See Figure 10-1 for more detail.

3.2.1 LED LATCHES AND DRIVERS U19, U20

The Decoder U25, Pin 15 selects the LED portion of the board. The data that appears on Bits BDØ through DB5, when this section is selected, will be clocked into the latches of U20. Only one of the bits will be high at any given time. U19 sinks the current from the LEDs and R14 through R19 limit the current for these LEDs.

3.2.2 KEYBOARD AND BUFFER U21

The Keyboard of the 808 consists of a membrane keypad arranged in 7 by 4 Matrix. The keypad is connected to the A1 Board via J2. Pins 1, 2, 6 and 11 are the rows, and Pins 3, 4, 5, 7, 8, 9, 10 are the column connections of J2. Using the Latches in U14 and U15, each column of the Matrix is strobed. When a key is depressed by the user and the Decoder U25 Pin 13 selects the Buffer U21, the Main Processor Board can determine which key was depressed. Using this data the Processor can act on commands.

3.2.3 ALARM CONTROL U22

The level that Bit DB7 is at when the Alarm Control is generated, by the Decoder U25 Pin 10, determines whether or not the Alarm Oscillator U23 is enabled. When slected the decoder line clocks Flip Flop U22. The output of this Flip Flop is then used, being buffered by U26, to control the oscillator. If DB7 is high, then the alarm will be audible, if DB7 is low, then the alarm is shut off.

3.2.4 POLARITY CONTROL FOR LCD U22

LCD Display requires an AC waveform such as in Figure 3-2 to be operated. The other half of U22 is used to latch data from Bit DB7 to U3. U3 in turn controls its own output along with the outputs of U1 and U2. These IC's, when strobed from U16, provide outputs that go from Vs to V_{adj} or ground, depending on the level DB7 was latched at. After being strobed the output voltage level goes back to a steady state voltage of V_s.

3.2.5 COLUMN CONTROL FOR LCD U4-U13

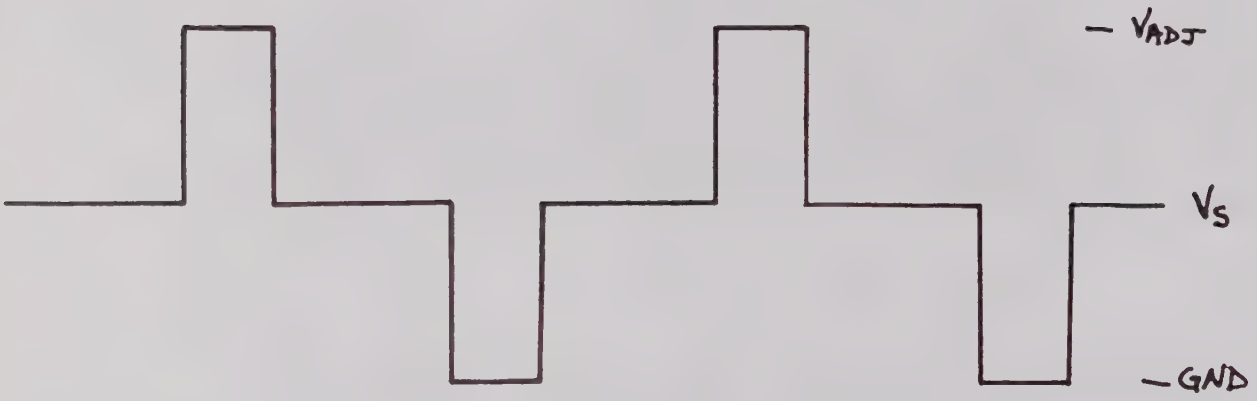
In order to drive the LCD column segments properly, the column voltages must fall between V_{adj} and ground. This is achieved by U24, R1, R2, R3, R4 and R13. The outputs of U24 are used as the supplies for U4 through U13. These IC's in turn drive the columns of the LCD display, see Figure 3-2. Whenever the column is opposite from row inputs, i.e. the row is at V_{adj} and the column is at -Vd see Figure 3-3 the LCD segment will be dark or visible. If the inputs are in the same direction then the segment will be silver or off. The control and data lines are level shifted to compensate for the setting of U24. The data on DBØ through DB4 is shifted by U17, RN4 and RN5 and appear on the inputs of the shift registers, see Figure 10-1. When the Main Processor Board selects the column control; the select line is level shifted by U25, R5 and R7 and then used to clock into the display data.

3.2.6 ROW LATCHES FOR LCD DISPLAY U14, U15

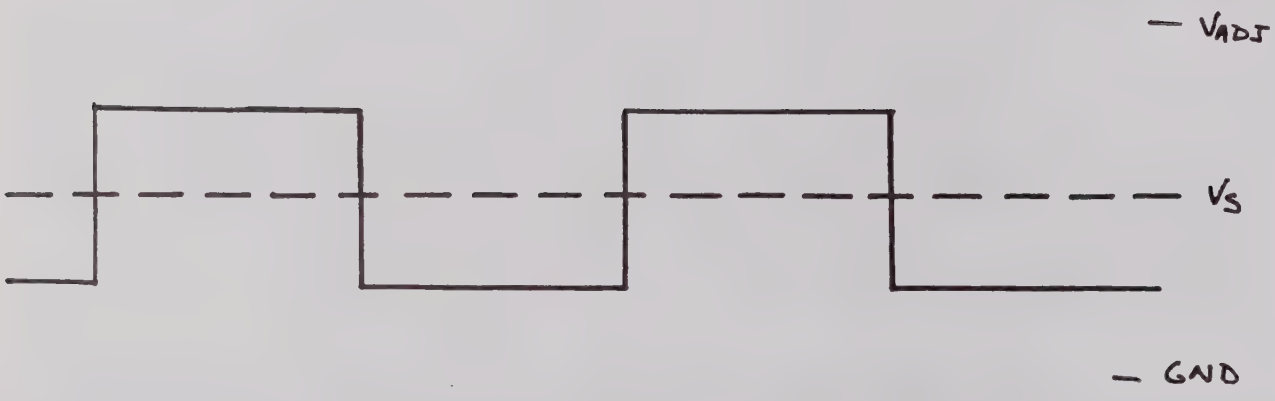
This section of the Keyboard/Display is used as strobing pulses for both the row drivers of the LCD and the keypad. When selected by the Main Processor, Bits DBØ through DB7 are clocked in by the select line from U25 Pin 4. In general the bits will be at the low level or ground. When a line is to be strobed the Main Processor sends a high bit to that line and then clears it.

4 MAIN PROCESSOR BOARD A2

The Main Processor provides all of the operating functions of the 808. This board also maintains the charging current for the battery pack. The Main Processor Board converts the battery power into the necessary supply voltages to operate the unit. The board operates the printer, keyboard, and display. It also collects data from the Analog Board or Keyboard.

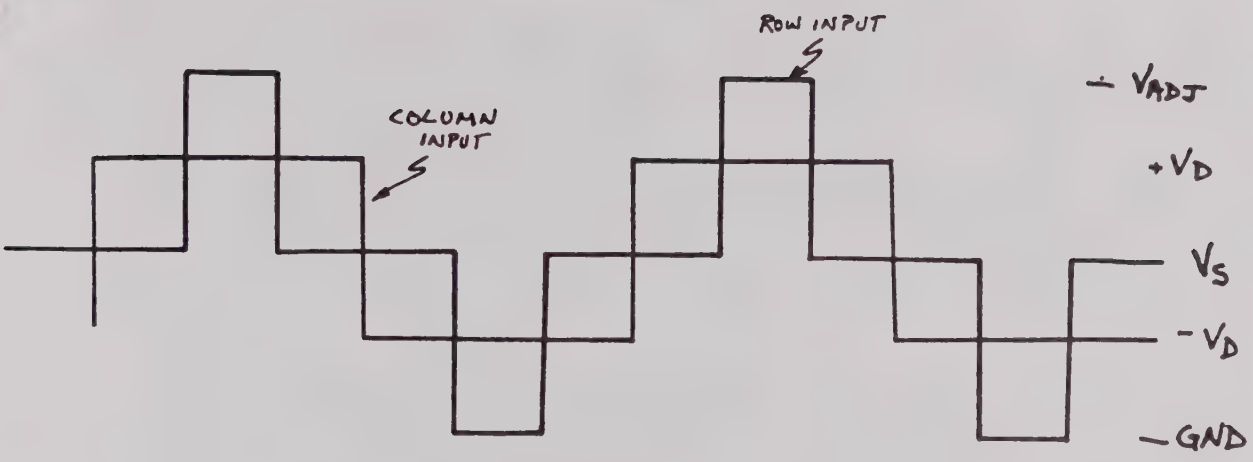


ROW INPUT

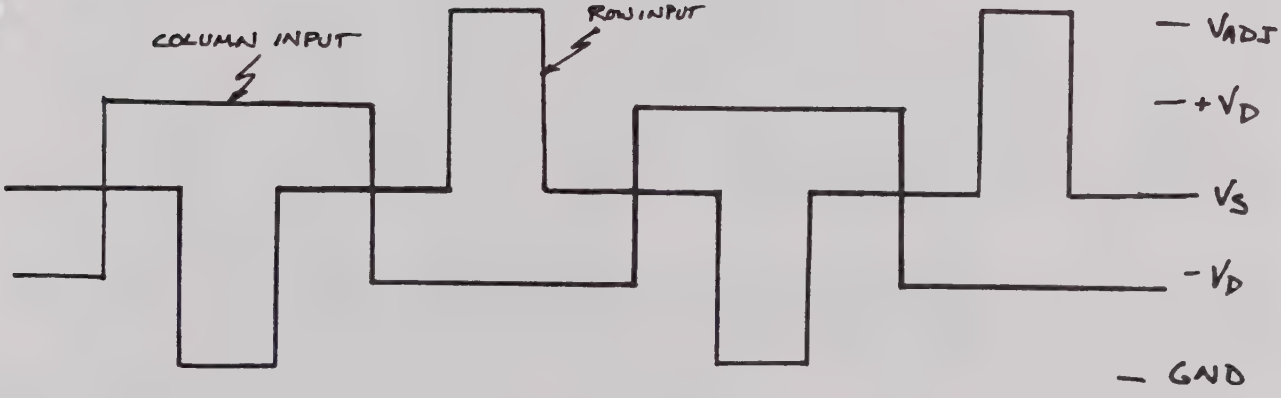


COLUMN INPUT

FIGURE 3-2 LCD INPUT WAVEFORMS



LCD SEGMENT IS OFF



LCD SEGMENT IS ON

FIGURE 3-3 SEGMENT INPUT CONDITIONS FOR ON AND OFF SEGMENTS

4.1 MAIN PROCESSOR BLOCK DIAGRAM

The Main Processor Board can be seperated into 2 major sections. The first one contains the Power Supplies and Charger, the other section contains a Microprocessor system and its control logic.

Figure4-1 is a drawing of the blocks in the power section. The battery charger takes the AC output from the Transformer Board via the connector J6 and converts it into a DC charging current. This DC current is then sent out through the other half of J6 to charge the battery. The charger circuit also provides a logic line to the microprocessor to indicate a loss of the charging current, i.e. loss of AC power to the unit.

The power from the battery pack comes to the Main Processor via J6. The voltage runs to a switch S1, a step-up power supply and the printer take up motor. When S1 is turned it activates two functions. Half of S1 connects the battery power to a 5V regulator and the other half is used to tell the processor which of two positions the switch is in. Once power is applied to the regulator the processor is turned on and running. The processor then sends a digital signal to the power control. The power control in turn enables the analog boards 5V and the switching power supply. When the unit goes into standby mode the processor shuts off the analog 5V and disables the switching supply to conserve power.

The step up switching power supply provides the 808 unit with 15V for the printer and $\pm$12V for the keyboard/display and the analog board.

Figure4-2 covers the blocks of the second portion of the Main Processor Board. The processor controls and maintains the other parts of this section. S2 is used as a master reset for the whole system. A Real Time Clock provides an oscillator input to the CPU. With this input the CPU maintains the 808's real time. All interval timing, the time of day, and other time requirements are maintained with the oscillator output.

The CPU also has two 8 bit parallel ports which are connected to the CPU on the Analog Board via J2. With these lines and the interrupt line, data and information are passed to and from the Main Processor Board and Analog Board.

For the rest of the system the data and address lines are used. The CPU on the main processor has the lower 8 bits of its address bus multiplexed with the data bus. The address strobe from the CPU provides the clock needed to latch the lower address lines. Once the address bits are obtained they go to the processors memory and a decoder. The CPU can select from any of the following parts in the microprocessor system.

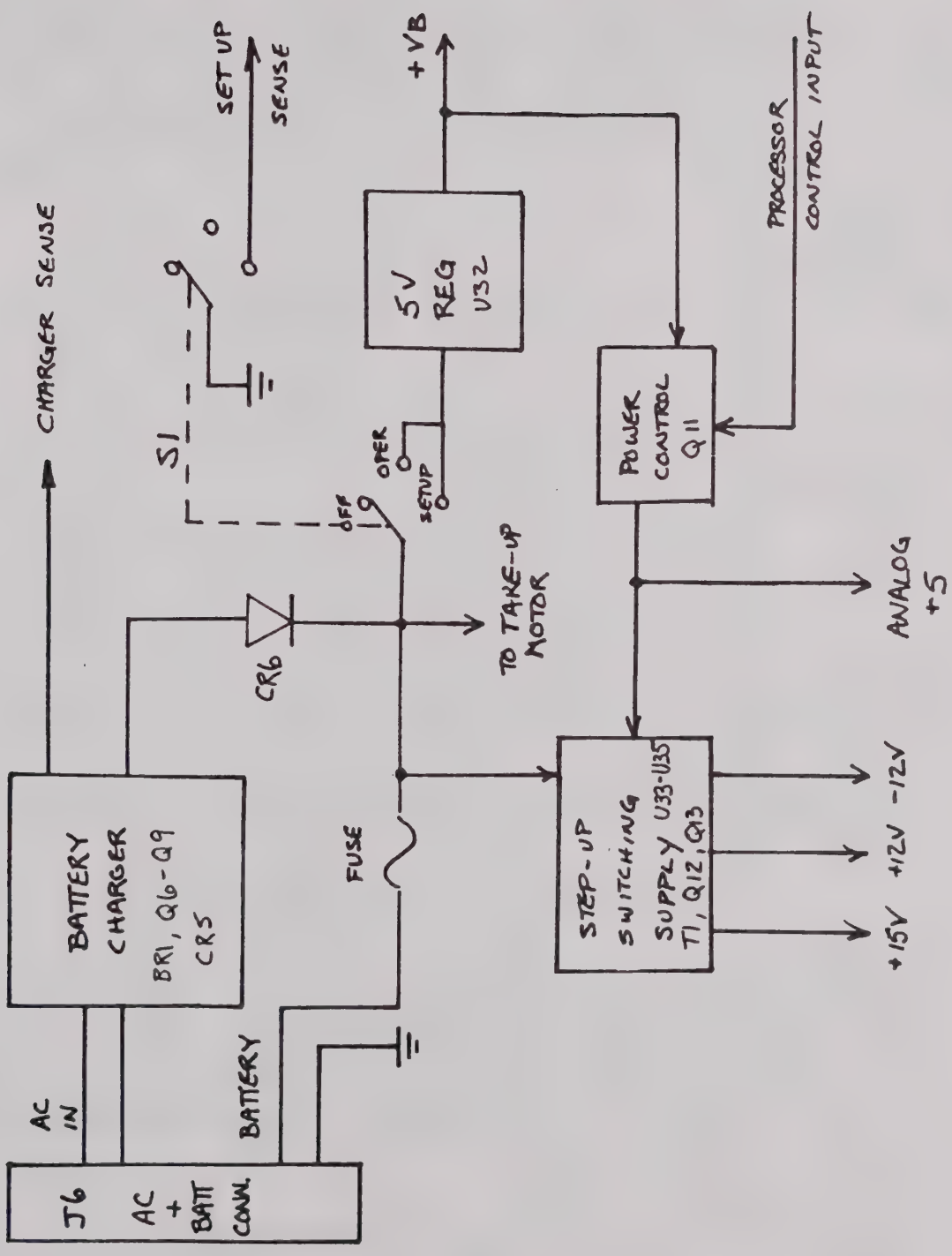


FIGURE 4-1 MAIN PROCESSOR 110356 BLOCK DIAGRAM, POWER SECTION

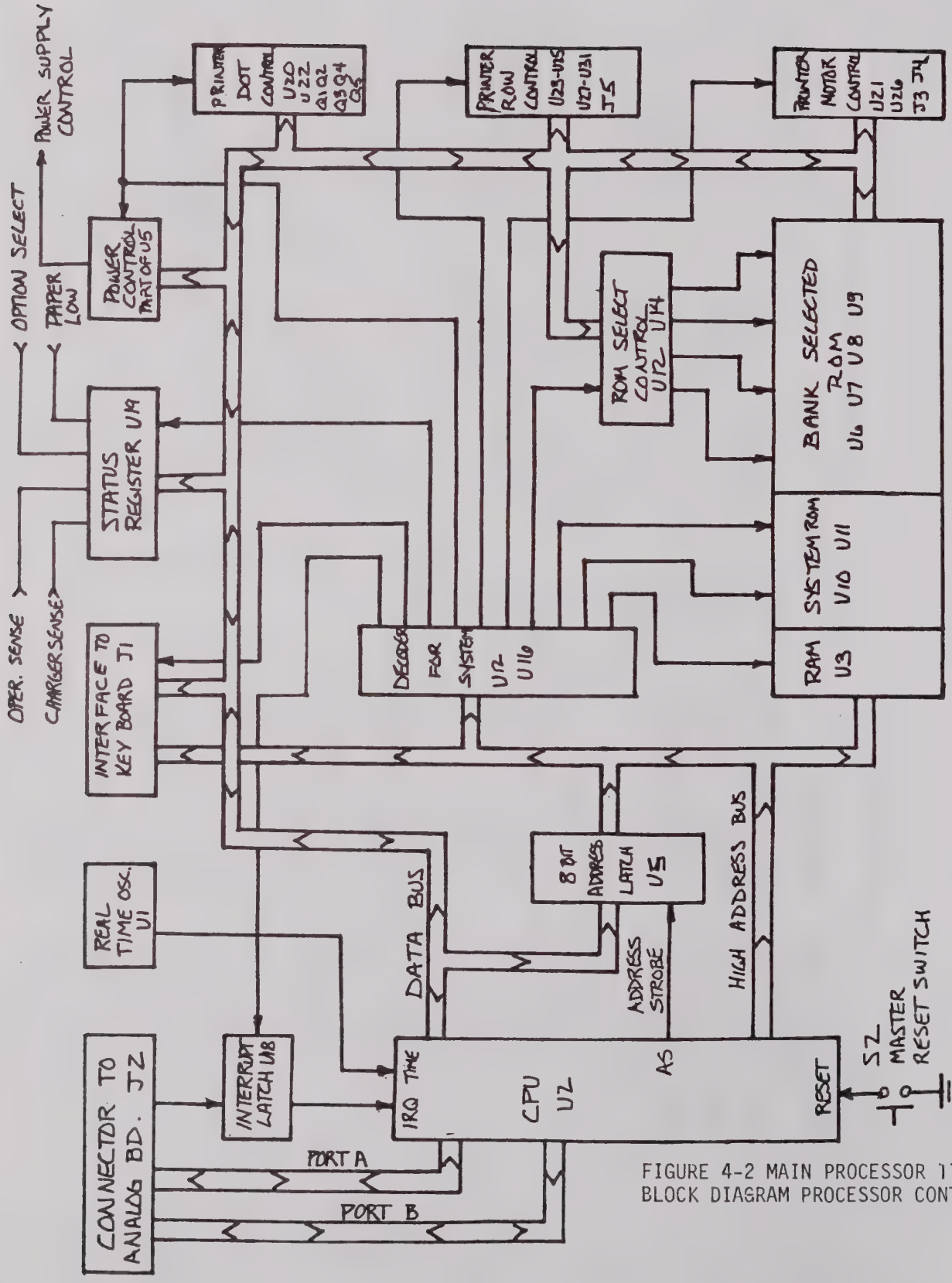


FIGURE 4-2 MAIN PROCESSOR 110356
BLOCK DIAGRAM PROCESSOR CONTROL

1. The Print Dot Control and Power On Control
2. The Printer Row Control
3. The Printer Takeup Motor
4. Keyboard/Display Interface
5. Status Port for the Board
6. RAM
7. ROM Selector/Decoder
8. Interrupt Reset

4.2 DETAILED DESCRIPTION

See Figure 10-2 for more information.

4.2.1 THE BATTERY CHARGER

The step down transformer provides the AC power to charger through the connections made through the 4 Pin Connector J6. The AC is rectified and filtered to DC power by BR1, C27, and C28. Upon initial turn on R15 and C29 provide a path for current to flow so that Q9 can be biased properly and activated. At the same time Q7 is also properly biased allowing the voltage to drop and current to be pulled from the base of Q6. This biases Q6, allowing charging current to flow from the collector to R14 and CR5 and out to the battery pack through connector J6. As the voltage at the anode of CR5 rises or falls, i.e. the battery pack is charged or requires charging, the current level through R17 and the adjustment of R18 into the base of Q9 also rises or falls. The changes in this base current cause the same type of changes in the collector current of Q9, R18 controls the exact amount. This now has the opposite effect on the base current of Q7 causing the collector current of Q7 to follow. Thus, the base current of Q6 is increased or decreased. These changes in the base current cause the same changes in charging current. This circuit therefore provides less charging current as battery becomes fully charged and more whenever the battery is slightly depleted.

The other transistor Q8 in this circuit is used in conjunction with R14 to provide a current limit to the charger. As the current increases the voltage drop across, R14 increased until it is high enough to turn on Q8. Once Q8 is turned on it clamps the base voltage of Q7 to emitter voltage of Q7. This shuts Q7 down and now limits the amount of current pulled from the base of Q6. With less current being pulled the charging current available also drops and is limited.

The remaining components CR6, R20 and R21 provide the charger sense line V_{se} to the microprocessor. As long as the charger has a power input, a DC voltage will appear at the anode of CR6. This voltage level is preceived as a true state to the processor. Should the AC be removed, i.e. power failure, then the logic state drops to a false state initializing the unit to sound an alarm and flash the display.

4.2.2 5 VOLT PROCESSOR SUPPLY

Once S1 is close in either OPER or SETUP positions, it applies DC power to U32. The input at Pin 3 provides the reference for the other input at Pin 2. As the difference between these two pins changes so does the sink current into Pin 8 change. This varies the base current being pulled from Q10 which changes the voltage drop from its emitter to collector. This voltage drop regulates voltage V_B. V_B is the voltage that runs the processor and any other parts that are required to be maintained in standby mode.

4.2.3 ANALOG 5 VOLTS SUPPLY

V_B also goes to the emitter of Q11. Q11 acts as a switch for the other supplies and is turned on when signal P_{on} goes low. Once on, the voltage that appears at the collector now runs the Analog 5V and any other parts that are required to be turned on with P_{on}.

4.2.4 SWITCHING POWER SUPPLY AND ±12 VOLT REGULATORS

After the microprocessor turns Analog 5V, the switching power supply is then enabled. C40 along with C49 are needed for adjustment act as the timing capacitors for the switching pulses. Pin 10 of U33 sinks current every time a pulse occurs. This current turns Q13 on which then enables Q12. Q12 now sinks current from the battery pack through Inductor T1. When Q12 shuts off the lagging or stored current through the indictor now runs into the Diode CR9. There CR9 and C36, C37 rectify and filter the switching waveform to DC. R36, R37 and the adjustment of R35 control the voltage level of V_{pr} by feeding back a voltage level back to Pin 1 of U33 to adjust the voltage output. The parts R38, R39, CR10 and Q14 maintain that the 12 volt regulator U35 is shut off whenever the switching supply is disabled by the P_{on} signal going high.

The other half of T1 is used to invert the switching power supply pulses. Once inverted, CR8 and C35 rectify and filter the pulses to obtain the negative voltage necessary to drive the -12 volt regulator U34.

4.2.5 MICROPROCESSOR SYSTEM

The 6805 processor U2 has a multiplexed data-address bus. The address is created by using the octal latch U5 and clocked in by the falling edge of the address strobe appearing at Pin 6 of U2. The other IC's connected to the data bus are gated so that no data is transferred during the address setup. Once the address is obtained, different sections of the system may be selected. The ports A and B of this processor are 8 bit parallel ports used for data transmission to and from the Analog Board through the connections made through J2.

4.2.6 CENTRAL MEMORY OF THE PROCESSOR SYSTEM

Once the address is valid, the processor U2 obtains program information from U10 and U11 by using the Decoder U12. Data to be stored such as programmed by the user, is written into RAM U3. The other PROMs U6 through U9 are addressed by writing data to the latches of U14 and decoding it with the second half of U12. The processor when running will have only one of the PROMs U6 through U11 enabled at one time.

4.2.7 KEYBOARD/DISPLAY INTERFACE

The connection to the Keyboard/Display is made through the 34 pin connector J1. Once addressed by the processor U2 through the Decoder U12 output P4, the processor can read and write data to and from the other board. See Section 3 for more detail.

4.2.8 INTERRUPT CONTROL

When the Analog Board has need to communicate with the main processor board, it generates an interrupt by strobing the line from its board over to J2 of the processor board into the clock input of the latch U18, Pin 3. The output of this latch is connected directly to the interrupt input of the processor U2. When the processor seeks to clear the interrupt it addresses U16. Pin 7 of U16 provides the required logic level to reset the latch output high and thereby clear the interrupt.

Another input of U2 that generates an interrupt is the Real Time Clock input at Pin 37. The oscillator output from U1 Pin 4 is jumpered by connection G of W1 to Pin 37. The internal interrupt is handled by the processor and used to maintain the Real Time Clock of the 808. The total count of time is under software control.

4.2.9 STATUS REGISTER AND CONTROL LINES

The processor U2 turns on the printer voltage by addressing U20 with U16, Pin 15. Once addressed, the data is clocked in position 6D, Pin 14 of U20. This data bit now latched produces the signal P_{on} when it runs through the buffer U22.

The status register is the tri-state buffer of U19. The processor uses these buffers to determine the status of the paper low switch, the charger sense line V_{se}, the position of the power switch S1 and the status of option selectors of J7. The processor preceives these different functions as logic levels in the data read from this register.

4.2.10 PRINTER CONTROLS

The stepper motor and the takeup motor of the printer are controlled by the data transmitted from the processor to the address that enables the latches of U21. The data that is latched is used to drive the inputs of U26. U26 is an array of transistors used to sink the necessary currents to drive the two printer motors. Connections for the stepper motor are made with the 6 Pin Connector J3. The takeup motor is connected to the Main Processor Board by using the 4 Pin Connector J4.

Each character of the thermal printer consists of 5x7 matrix of dots. The processor causes the printer to print the top row of the matrix for 20 characters across. The sequence for a row starts off with the processor U2 sending data to the latches of U20. This data turns on Q1 using the transistor array U22 for a current sink. Q1 allows the current to flow causing the thermal print head to print the first dot for each character. The processor U2 then sends data to the latches of U27, U28, U29, U30, and U31. This data once clocked in determines which of the 20 characters are to have the first dot printed. The processor then proceeded to print the second dot by turning on Q2 and sending new data to the latches. This continues for third dot using Q3, the forth dot using Q4 and the fifth by using Q5. Each time new data is latched into U27 through U31 to determine which characters are to have their dots printed. After the 100 dots (20 characters, 5 dots each) of the characters have been processed, the processor causes the stepper and takeup motor to move by sending data to the latches of U21. Once latched, the data causes current to flow through the motors. The motors now move the printer to the next row of dots and next row is printed. The above sequence is repeated until all of the 7 rows of characters have been processed.

5. ANALOG BOARD A3

The Analog Board is responsible for the measuring and conversion of Analog or Pulse Data into a form the Main Processor Board can process. The board controls the incoming gain of the Analog Input Channels and multiplies voltage and current inputs together to get watts reading. It also samples and converts these signals into a digital format. Other functions include handling the pulse inputs of the 808 and controlling relay contacts.

5.1 ANALOG BOARD BLOCK DIAGRAM

The Analog Board may be seperated into 3 sections. The first section is the Processor and its programming. The next is the Analog Measuring Block consisting of buffers, gain stage and analog to digital converter. The final portion monitors the pulse inputs and controls the relays and analog section.

The Processor System consists of the CPU U44, the Octal Latch U39, the Program U37, the Decoder U40, and the Connector J5. The CPU U44 uses the Octal Latch to address the Program U37. Once addressed the Program U37 provides the information needed for the board operation.

This information determines when and what data is to be sent to or from the Analog Board and Main Processor Board via the J5 connections. It also determines when the Analog measuring block is to sample, change gains, multiply or convert analog to digital. This same program addresses the relay and pulse input hardware.

The second section of this board makes up the Analog Measuring Circuit. Inputs to be monitored are connected to the board via J1-J4. Connector J1 provides for the voltage phase inputs and J2-J4 connect the current channels. Once connected to the board the attenuators and buffers of U1-U4 provide voltages to sampling switches of U4 and U6. Outputs from these switches are connected to their respective autorange stages (U7 and U9, U12 and U13). With feedback from the CPU U44, the autorange stages are kept at an optimal level for the A/D converter.

The final section monitors pulse inputs and activates the relays. Using the tristate buffers of U41-U43 and associated hardware U32, U34-U36 the initiator or sync pulses can be monitored. The controls of U30 and U31 provide the necessary lines to activate relays K1 and K2. The final portion of this section is composed of the latches of U24-U29. Data sent to these latches determine when to sample, what gain to use, when to multiply, and what to convert in the analog measuring section.

5.2 DETAILED DESCRIPTION

See Figure 10-3 for more information.

5.2.1 MICROPROCESSOR SYSTEM

The Processor U44 is the same type used on the Main Processor Board, a 6805. A valid address is therefore obtained by latching the data for the address into U39 with the address strobe line coming from Pin 6 of U44. After obtaining the address, the processor can either use the programmed memory U37 and U38 or the Decoder U40. The Decoder U40 allows the processor U44 to address and control the rest of the board.

5.2.2 VOLTAGE CHANNELS AND AUTORANGING

The three phases of voltage to be measured are connected to this board by the connector J1. Pin 1, 3 and 5 are the A, B, and C phases and Pin 2 is the neutral or return line. Each phase along with the neutral line runs to individual differential amplifiers of U1 and U2. These amplifiers after attenuating the input signal provide the inputs to the common autoranging stage. The amplifiers of U7 form the autoranging stage for the voltage channels. The Analog Switches of U5 select which of the voltage phases is connected to this stage. Data sent from the processor to latches of U24 is latched by the decoder line U40 Pin 13. The output of the latches now determine which switch of U5 is on. Once on, the switch connects a given voltage channel to the autoranging stage.

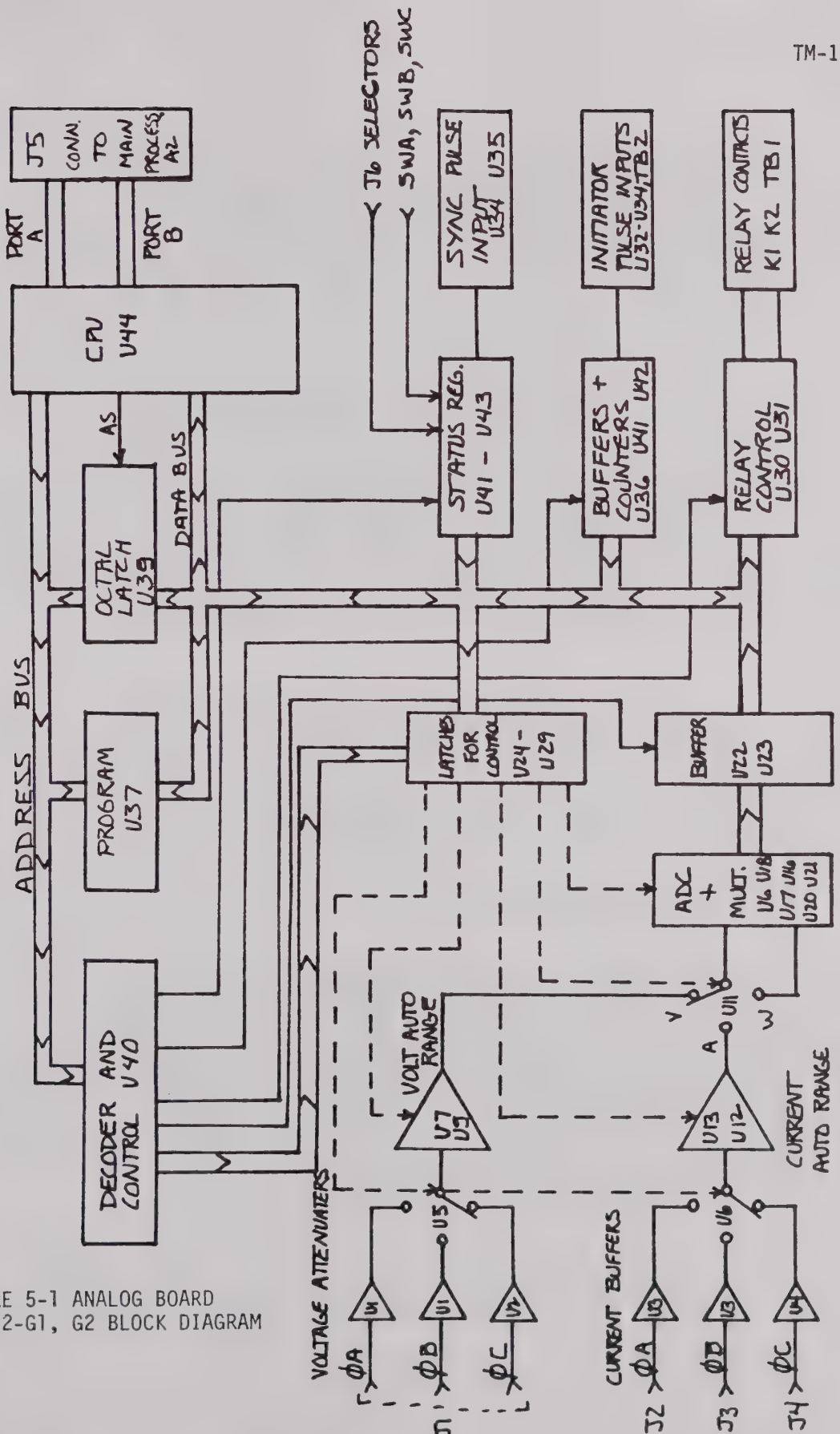


FIGURE 5-1 ANALOG BOARD
110362-G1, G2 BLOCK DIAGRAM

The gain for the voltage autoranging amp is controlled by the Analog Switches of U9, Pins 1, 2, 3, and Pins 6, 7, 8. Data from the processor is latched into U27 with decoder line U40 Pin 12. This data is now used to enable the switches of U9 to connect R7, R48 and R83 into the gain loop of the Amplifier Circuit U7. In this way the processor controls which gain level to use for voltage channels.

5.2.3 CURRENT CHANNELS AND AUTORANGING

The requirement for the 808 maintains that the inputs for the current channels be a voltage level proportional to half the current level of the phase being measured, i.e. 0.5V per amp. The three proportional inputs are connected to the analog board by the connectors J2, J3 and J4. The inputs each go to the differential amplifiers of U3 and U4 where Pin 3 of the connectors J2, J3 and J4 is the input side and Pin 4 the return. These individual amplifiers provide for a buffer stage for the current section. The processor selects which channel it will process by sending data to U25 and latching it with the decoder line U4, Pin 13. This data now determines which Analog Switch is on. The switch which is now on connects the channel it is associated with to the autoranging amplifier U13.

The gain for the current autoranging amp is controlled by the analog switches of U12, Data from the processor U44 is latches into U26 with the decoder line U40, Pin 12. The latched data now enables one of the switches of U12. The switch of U12 once enabled, connects as Resistor R51, R52, R53, R81, R85 into the gain loop of U13. Thus the processor can change the gain of the current channels by switching different resistors in and out of the gain circuit.

5.2.4 SAMPLING AND MULTIPLEXING

After each signal has passed through the autoranging amplifiers, the signals go to sample hold IC's, U10 for the voltage inputs and U14 for current. These IC's will hold the voltage level that appeared on their inputs when a signal from U29 Pin 10 goes low. The level once held can now be routed to the A/D conversion through the multiplexer U11. Data sent to the latches of U28 when clocked in by the decoder line U40, Pin 11 will select whether current, voltage, or wattage is to be connected to the A/D input U17. Once converted, the digital data for a given channel is squared and added to previous squared samples. Thus, after sampling over a few cycles the CPU U44 may calculate the true RMS value of voltage or current.

5.2.5 ANALOG TO DIGITAL CONVERSION AND MULTIPLICATION

The processor enables the conversion by sending data to the latch U29 Pin 2. Then the conversion starts with the approximation register U21 having Bit Q11 set. This bit runs over to the D/A converter U20, whose current output controls the buffer U16. This level is now compared, by using U17, to the sample coming from the multiplexer U11. If the bit on the output is to be set the error signal from U17 will be true, setting the bit, and the register U21 will go onto the next bit until the conversion is complete. Once completed the Register U21 takes Pin 3 low to signal the processor that the data in the buffers U22 and U23 is valid. This data provides the processor U44 with measurement and information needed for autoranging measurements.

The wattage measurements or multiplication of current and voltage together is done by the D/A converter U20. While a current channel is selected by U11, the processor switches the voltage channel, U11 Pin 15 into the reference input of the D/A converter U20 Pin 15 by using the Amplifier U18. The output of the D/A Converter is now sampled and held by U10. The held voltage level now runs to the multiplexer U11 and out to U17 for conversion.

5.2.6 CONTROL SIGNALS AND DIGITAL INPUTS

The remaining sections of the board allows the processor to determine the state of control lines, sense the 808 user's pulse input or control the alarm contacts.

When the processor needs to determine the digital state of the different positions of J6, SWA, SWB or SWC, it uses the decoder U40, Pin 7. This line selects the buffers of U41, U42 and U43 providing an 8 bit word to the processor. The bits of this word provides necessary information to the processor to run the program for the analog board.

The initiator pulses and external sync pulse are connected to the board by using the barrier block TB1. After the inputs' voltages are normalized by the opto-couplers U32, U33 and U35, the respective outputs run the flip-flops of U34. The flip-flop for the initiator pulses run a counter U30. The counter output can then be accessed by the processor using the buffers of U41, U42 and the Decoder Line U40, Pin 9. The flip-flop for external sync input goes to the buffers of U42 and is read by the processor along with the positions of J6.

6. TRANSFORMER BOARD A4

6.1 BLOCK DESCRIPTION

The Transformer Board is used to stepdown and isolate the power line voltage to an input voltage for the battery charger on the Main Processor Board A2.

6.2 DETAILED DESCRIPTION

For more detail see Figure 10-4. The line cord is connected to the board using the holes E2 and E3. Using the connections made by S1 the board can be set to provide proper voltages to the primary side of T1. After stepping the voltage down the outputs of T1 go to the holes E5 and E6. A harness runs from these holes to a 4 pin connector P1 which mates with the connector J6 on the Main Processor Board A2.

7. PRINTER ASSEMBLY A5

7.1 BLOCK DIAGRAM

Figure 7-1 shows the block diagram for the printer. Digital data from the Main Processor Board comes through the A1-P1 connector to the print head. After a row of dots is printed, the Main Processor Board sends data through the connectors P1 and P2. This data runs the stepmotor and takeup motor. The printer paper is now in the position for the next row of dots, the paper low switch.

7.2 DETAILED DESCRIPTION

Figure 10-1 shows the mechanical assembly for the printer. All of the data and control lines for the print assembly come from the A2 board.

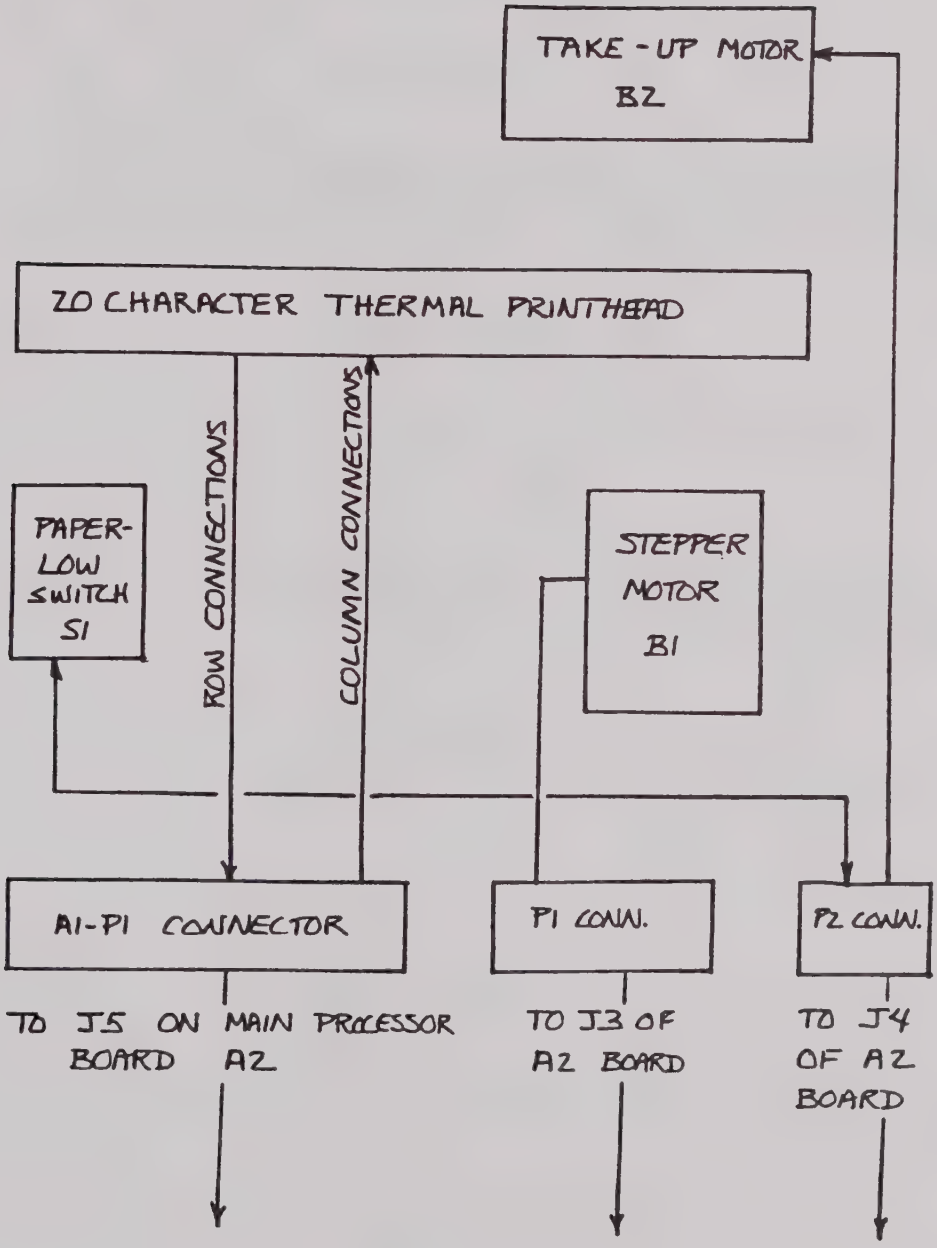


FIGURE 7-1 PRINTER ASSY. 110345-G1,G2 BLOCK DIAGRAM

8 MAINTENANCE

8.1 SCOPE

This section contains test and calibration procedures and other data that will help insure continuity of service of the 808 Power Demand Analyzer. Items of special equipment designed for field service testing of the unit are described and step-by-step instructions are provided for their use.

8.2 TEST EQUIPMENT REQUIRED

Table 8-1 lists test equipment recommended for calibration and maintenance of the unit. Substitution of equivalent equipment may be made.

WARNING

THESE SERVICING INSTRUCTIONS ARE FOR QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATOR'S MANUAL UNLESS YOU ARE QUALIFIED TO DO SO.

READ INSTRUCTIONS CAREFULLY

Because of the potential shock or fire hazards, do not perform any task for which you are not qualified.

TABLE 8-1 TEST EQUIPMENT REQUIRED

ITEM	CHARACTERISTICS	MODEL
VOLTMETER	DC General Purpose Accuracy: ±1%	Fluke 8600A
OSCILLOSCOPE	Bandwidth: 0Hz to 10MHz	Philips PM3233
TIMER/COUNTER	10Hz-80MHz Accuracy: ± 1 Count ± Time Base Error	Philips PM6612
WATTMETER	Volt and Amp Reading Accuracy: ±0.05%	Dranetz 3100
AC SOURCE	Sinewave Voltage Outputs 0 to 10Vrms Stability ± 0 to 600Vrms Stability ±0.1Vrms Frequency 45.0 to 65.0Hz Stability ±0.1Hz	Khrone-Hite K1000A Audio Oscillator with Bogen MT125B Audio Amp and Transformers, step-up ACME TA1-81000 step-down Signal 241-3-10
CONNECTOR KIT	Mates with 808 Input Connectors	Dranetz P/N 110656
DC SUPPLY	0 to 10V Stability: ±0.01V	Hewlett Packard 6284A with 100,000μF capacitor on the output

8.3 PRELIMINARY SETUP (UNIT DISASSEMBLY)

Disassemble the entire unit for calibration. Unit should be set in the OFF position and unplugged before disassembly is attempted.

1.) Remove the four black screws, two on each side, and the two small rubber feet from the top of the unit case. Remove case top.

2.) Remove the two white retaining blocks, noting their direction. Then loosen the bracing bar so that the sides of the case open slightly.

3.) Remove the key shaft by compressing the two retension springs around it. Remove the ribbon cables from the large boards. Remove the nylon screw from the rear panel.

4.) Remove the front panel and the Main Processor Board together. Note these two boards are still connected on the bottom, be careful not to bend or break the flex cable which connects the main processor board to the printer. As the boards are being pulled out, disconnect the battery connector from J6 connector of the Main Processor Board. Place the front panel and Main Processor Board on the bench.

5.) Remove the communication board, if the unit has this option, and place this board on the bench. Refer to TM-111300 for specific details on Communication Option 104.

6.) Unscrew small rubber feet near the bottom of the rear panel. Remove the rear panel and analog board together. After they are out of the case put the analog board on the bench.

7.) With the rear panel still connected to the battery pack, remove battery pack by taking out four screws from the bottom of the case. Place on the bench.

8.) Reassemble the unit outside its case on the bench as seen in Figure 8-1. Reconnect all connectors to the boards. At this time do not reconnect communications boards if the unit has this option.

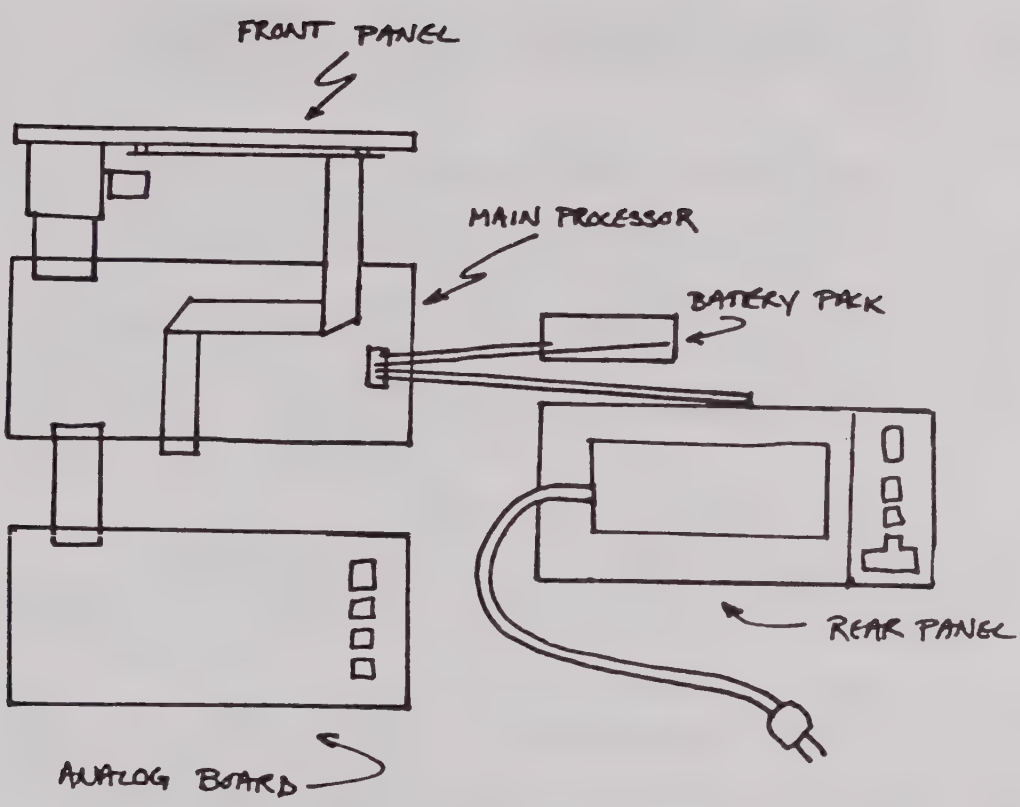
9.) Refer to Figure 10-6 to put the unit back together.

8.4 MAIN PROCESSOR BOARD 110356

In general this board will not need any adjustments.

8.4.1 Battery Charger Current Level Adjustment

1.) Make sure the 808 power switch is still in the OFF position. Disconnect the battery pack and connect the regulated DC supply in its place. Plug the AC line cord in to apply power to the battery charging circuit. Always make note of the battery's polarity.



Top view of reassembled unit on the work bench.

FIGURE 8-1

2.) Set the DC supply to 6.8V and adjust R18 on the processor board such that the current through R14 is 15mA±5mA.

3.) Set the DC supply to 6.4V and verify that the current through R14 is 420mA or higher. Disconnect the AC power and reconnect the battery pack.

8.4.2 Power Supplies Voltage Adjustment

1.) Using the keyshaft as a lever arm turn 808 onto the setup position, two positions clockwise on the switch S1.

2.) With the unit ON and functioning adjust R28 until the voltage across C15 near U8 is 5.30V±0.05V.

3.) Adjust R35 until the voltage across C25 is 15.0V±0.1V.

8.4.3 Real Time Oscillator Adjustment

1.) Connect the frequency counter to U1 Pin 4 and adjust C1 for a period 1953.125µsec ±0.001µsec.

8.5 DISPLAY - KEYBOARD 110350

8.5.1 LCD Contrast Adjustment

1.) With the 808 still ON adjust R13 to maximize the contrast of the LCD display, i.e. dark alpha-numerics with light background,

8.6 ANALOG BOARD - 110362

8.6.1 Analog to Digital Converter's Reference Adjustments

1.) With the 808 unit still ON short the two pins of position W4 of J6, J6 is near RN1, together.

2.) Depress the red switch, S2, on the Main Processor Board 110356.

3.) Set the A/D reference by adjusting R66 such that the voltage from U18 Pin 6 to ground is 10.000V±0.008V.

4.) Remove short from position W4 of J6. Depress red switch S2 on the Main Processor Board 110356.

8.6.2 Common Mode Adjustment for Voltage and Current Channels

1.) Using the Voltage Cable PN 110686 or the voltage connector from the Connector Kit PN 110656, short phase A, B, and C inputs of J1 Pins 1, 3, 5 to the neutral conductor of J1 Pin 2. Now apply 115Vrms from the AC source to the shorted inputs and the ground conductor, J1, Pin 6.

2.) Adjust each voltage channel's AC common mode by minimizing the outputs with the use of the Pots R5, R12, R19. Adjust Channel A with R5 and its output on U1 Pin 7. Channel B with R12 and its output on U1 Pin 1. Channel C with R19 and its own output on U2 Pin 1. In each case the output should be reduced to 115mV peak or less. Disconnect the 115Vrms.

3.) Using the current connectors from the Connector Kit 110656, connect Pin 3 of J2, J3 and J4 together. Do the same with Pin 4 of J2, J3, and J4. Short these two connections together and apply 10Vrms from this short to ground, Pin 6 of J2, J3, and J4.

4.) Adjust each channel's AC common mode by minimizing the outputs with the use of the Pots R27, R34, R41. Channel A is adjusted by R27 and the output of U3 Pin 7. Channel B is adjusted by R34 and the output of U3 Pin 1. Channel C is adjusted by R41 and the output of U4 Pin 1. In each case the output should be reduced to 10mV peak or less. Remove 10Vrms from the inputs.

8.6.3 DC Offset Adjustment for Voltage, Current, and Wattage

1.) To adjust the DC offset to the Analog board, short the two pins of position W5 of J6 together. Depress the red switch S2 on the Main Processor Board.

2.) Leave the prompt mode of the 808 and set the status printout for all channels of current. Refer to Operator's Manual for proper sequence of keys for 808 keyboard.

3.) Adjust R60 so that the status printout of the current channels is as close to 0.0000 A, for all three channels, as possible. A typical reading for the individual channels is 0.0100 A. Check the adjustment by displaying total Avg. volts on the display. The total should read 0.0000V. If it does not, readjust R60 slightly until it does.

4.) Display total watts on the 808. Adjust R55 until watts display zero's or goes as low as possible.

5.) Remove short from position W5 on J6 and depress red switch S2 on the Main Processor Board 110356.

8.6.4 Voltage Channel's Gain Adjustment

CAUTION: HIGH VOLTAGE - ELECTRIC SHOCK HAZARD

1.) To adjust voltage channels input gain, apply 600.0Vrms±0.3Vrms between the voltage inputs J1 Pins 1, 3, 5 and neutral J1 Pin 2. Verify that the ground Pin J1 is tied to the AC source ground.

2.) Display on the 808's LCD Channel A's voltage. Adjust R6 so that the 808 display reads 600.0V±3.0V. Verify that the setting agrees with the wattmeter's reading.

3.) Repeat step 2 for Channel B. Use R13 to adjust Channel B's reading.

4.) Repeat step 2 for Channel C. Use R20 to adjust Channel C's reading.

5.) After all voltage channels have been adjusted, decrease the AC source output to 300.0Vrms±0.2Vrms. Verify that each of the voltage channels reads 300.0V±1.8Vrms. Repeat steps 1 through 4 if necessary. Remove 600V input.

8.6.5 Current Channel's Gain Adjustments

1.) To adjust current channels' input gain apply 5.000Vrms±0.003Rms between Pin 3 of J2, J3, J4 and Pin 4 of J2, J3, J4. Connect Pin 6 of J2, J3, J4 to the ground of the AC source. Note on the 808 current channels 1 Amp is equal to 0.5V on the inputs.

2.) Display Channel A current and adjust R28 until the display reads 10.00A±0.05A. Verify that the reading agrees with the wattmeter's reading.

3.) Repeat step 2 for Channel B. Adjust Channel B's reading by turning R35.

4.) Repeat step 2 for Channel C. Adjust Channel C's reading by using R42.

5.) After the current channels have been adjusted apply 2.500Vrms±0.013Vrms. Verify that each of the current channels reads 5.000A±0.025A. If necessary repeat steps 19 through 22. Reapply the 5.000Vrms±0.003Vrms to current channels.

8.6.6 Wattage Gain Adjustment

1.) Apply 600.0Vrms±0.3Vrms to all three voltage channels and 5.000Vrms±0.025Vrms to the current channels. Verify that both voltage and current input are in phase with one another, i.e. PF=0.99 or 0.0 degrees between them. Set the 808 status to print out all channels of wattage.

2.) The wattage reading generated by voltage and current inputs to the 808 should now read 6.000KW±6W on the three channel status printout.

3.) The wattage gain for all three channels is adjusted by using R62. Adjust R62 until all three channels on the status printout read 6.000KW±60W. Verify the printouts with the use of the wattmeter.

4.) Shut unit OFF, disconnect AC power and inputs, and reassemble the unit.

9 REPLACEABLE PARTS LIST

The Replaceable Parts List identifies all the parts in the 808. For each part, the reference designation (if applicable) is shown, along with the part number, the manufacturer's code number and description. Parts location drawings are included for each assembly.

TABLE 9-1 LIST OF MANUFACTURERS

MAN. CODE	MANUFACTURER
00779	AMP Inc., Harrisburg, PA 17105
13103	Thermalloy Inc., Dallas, Texas 75234
23207	Dranetz Technologies, Inc. Edison, New Jersey 08818
28520	Heyco Inc., Kenilworth, New Jersey 07033
2W733	Belden, Richmond, IN 47374
51406	Murata-Erie Inc., Marietta, GA 30067
52458	Magnum Corp., Erie, MI 48133
62806	United Carr Supply Division of TRW, Plainfield, New Jersey 07063
81349	On Mil Spec List. Manufactured to meet Military specifications. Available from a variety of suppliers.
83014	Nylatch-Hartwell Corp., Palcentia, CA 92670
848430	Lee Spring Co., Brooklyn, NY 11201
	Mabuchi Motor Co., Ltd., N.Y., N.Y. 10016

REPLACEABLE PARTS LIST

808 ELECTRIC POWER DEMAND ANALYZER

MAINFRAME P/N 110300-G1, G2

REF. DESIG	PART NO.	MAN. CODE	DESCRIPTION
A1	110350	23207	KEYBOARD/DISPLAY
A2	110356	23207	MAIN PROCESSOR
A3	110362-G1, G2*	23207	ANALOG BOARD
A4	110368-G1, G2*	23207	TRANSFORMER BOARD
A5	110345-G1†,G2††	23207	PRINT ASSY.
	110610	23207	DISPLAY CABLE
	110611-G1	23207	ANALOG CABLE
BT1	47B050CE3001	19209	BATTERY
	SR-5MN-3	28520	STRAIN RELIEF
	17205-BLK	2W733	POWER CORD
	103255	23207	SWITCH LOCK
	LC-022D-12	848430	SPRING
	110325	23207	BATTERY PLATE
	110338	23207	KEYBOARD OVERLAY
	110339	23207	KEYBOARD BEZEL
	110344-G1†,G2††	23207	KEY SHAFT
	104852	23207	MEMBRANE SWITCH

*Either G1 or G2 will be in the unit.
†G1 Only - 110300-G1
††G2 Only 110300-G2

REPLACEABLE PARTS LIST

KEYBOARD/DISPLAY A1 P/N 110350

REF. DESIGN	PART NO.	MAN. CODE	DESCRIPTION
	110634	23207	FISH PAPER
	110633	23207	SHIM
	110346	23207	RETAINER BRKT.
	110702	23207	ZEBRA STRIP
	110703	23207	ZEBRA STRIP
	7717-7N	13103	MOUNTING PAD
	PKM11-4A0	51406	AUDIO ALARM
C1-C11	103208-G4	23207	CAP, 0.1µf±20%, 50V
C12,C13	104067-G8	23207	CAP, 2.2µf±10%, 25V
C14,C15	104020-G1	23207	CAP, 470pf±5%, 500V
CR1-CR7	104412-G2	23207	DIODE
DS1-DS4	104427-G1	23207	LED
DS2,DS6	104427-G2	23207	LED
DS3,DS5	104427-G3	23207	LED
J1	102160-8	00779	RT. ANGLE CONN., 34 PIN
J2	1-650455-1	00779	RT. ANGLE HEADER, 11 PIN
	102312-2	00779	PART OF J1
R1,R2	RN55C8871F	81349	RES, 8.87K±1%, 1/10W
R3,R4	RN55C4121F	81349	RES, 4.12K±1%, 1/10W
R5	RCR07G512J	81349	RES, 5.1K±5%, 1/4W

REPLACEABLE PARTS LIST (Cont'd)

KEYBOARD/DISPLAY A1 P/N 110350 (Cont'd)

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
R6	RCR07G623J	81349	RES, 62K±5%, 1/4W
R7,R10	RCR07G102J	81349	RES, 1K±5%, 1/4W
R8	RCR07G203J	81349	RES, 20K±5%, 1/4W
R11,R12	RCR07G474J	81349	RES, 470K±5%, 1/4W
R13	104701-G2	23207	RES. VAR., 20K±10%, 1/2W
R14,R18	RCR07G241J	81349	RES, 240ohm±5%, 1/4W
R15,R17	RCR07G361J	81349	RES, 360ohm±5%, 1/4W
R16,R19	RCR07G121J	81349	RES, 120ohm±5%, 1/4W
RN1,RN2	104798-G3	23207	RES. NETWORK, 51K
RN4	104798-G1	23207	RES. NETWORK, 20K
RN5	104798-G2	23207	RES. NETWORK, 8.2K
U1-U3	104203-G5	23207	IC, ANALOG MPX
U4-U13	104206-G5	23207	IC, SHIFT REG.
U14,U15	104202-G3	23207	IC, QUAD LATCH
U16,U17,U26	104225-G8	23207	IC, LVL TRANS
U19	104222-G4	23207	IC, BUFFER DRIVER
U20	104225-G2	23207	IC, HEX LATCH
U21	104387-G1	23207	IC, TRI-STATE BUFFER
U22	104201-G1	23207	IC, DUAL F-F
U23	104200-G5	23207	IC, QUAD NAND

REPLACEABLE PARTS LIST (Cont'd)

KEYBOARD/DISPLAY A1 P/N 110350 (Cont'd)

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
U24	104236-G2	23207	IC, OP AMP
U25	104388-G1	23207	IC, DECODER
U27	104252-G1	23207	IC, LCD DISPLAY

REPLACEABLE PARTS LIST

MAIN PROCESSOR BOARD A2 P/N 110356

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
BR1	104428-G1	23207	BRIDGE RECTIFIER
C1	104109-G5	23207	CAP. VAR, 4-18pf, 250V
C2,C6,C7	104016-G4	23207	CAP. 20pf±5%, 500V
C3,C4,C10-C12, C29,C38,C41, C42	103209-G2	23207	CAP., .22µf±20%, 50V
C5	103209-G3	23207	CAP., .47µf±20%, 50V
C8,C9,C13-C24, C26,C31,C44,C47	103208-G4	23207	CAP., .1µf±20%, 50V
C25	104067-G9	23207	CAP., 10µf±25%, 25V
C27,C28,C35	104075-G2	23207	CAP., 470µf±20%, 25V
C30	104020-G3	23207	CAP., 620pf±5%, 300V
C32	104075-G1	23207	CAP., 220µf±20%, 25V
C33,C34	104075-G3	23207	CAP., 1000µf±20%, 10V
C36,C37	104075-G4	23207	CAP., 1000µf 20%, 25V
C39	104022-G4	23207	CAP., 200pf±5%, 500V
C40	104018-G5	23207	CAP., 150pf±5%, 500V
C43,C45,C46	104067-G8	23207	CAP., 2.2µf±1%, 25V
C49	104017-G7	23207	CAP., 51pf±5%, 500V
CR1,CR3,CR4	104412-G2	23207	DIODE
CR2	104429-G2	23207	DIODE, ZENER
CR5	104430-G1	23207	DIODE, SCHOTTKY

REPLACEABLE PARTS LIST (Cont'd)

MAIN PROCESSOR BOARD A2 P/N 110356 (Cont'd)

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
CR6,CR7	104429-G1	23207	DIODE, ZENER
CR8	104408-G1	23207	DIODE, FAST RECOV.
CR9	104431-G1	23207	DIODE, SCHOTTKY
CR10	104429-G3	23207	DIODE, ZENER
F1	107545-G1	23207	FUSE, 8A
J1,J2	102160-8	00779	RT. ANGLE CONN. 34 PIN
J3	640454-6	00779	POST HEADER 6 PIN
J4	640454-4	00779	POST HEADER 4 PIN
J5	2-640455-5	00779	RT. ANGLE HEADER 25 PIN
J6	350430-1	00779	CONNECTOR 4 PIN
J7	87543-3	00779	HEADER, 6 PIN
Q1-Q5	104541	23207	TRANSISTOR
Q6,Q10	104532	23207	TRANSISTOR, PWR.
Q7-Q9	104505	23207	TRANSISTOR
Q11,Q14	104527	23207	TRANSISTOR
Q12	104547-G1	23207	TRANSISTOR MOSFET
Q13	104506	23207	TRANSISTOR
R1	RCR07G226J	81349	RES., 22M±5%, 1/4W
R2	RCR07G474J	81349	RES., 470K±5%, 1/4W
R3	RCR07G105J	81349	RES., 10M±5%, 1/4W

REPLACEABLE PARTS LIST (Cont'd)

MAIN PROCESSOR A2 P/N 110356 (Cont'd)

REF. DESIG.	PART NO.	MAIN CODE	DESCRIPTION
R4	RCR07106J	81349	RES., 10M±5%, 1/4W
R5	RCR07G203J	81349	RES., 20K±5%, 1/4W
R7-R12,R16, R25, R33	RCR07G102J	81349	RES., 1K±5%, 1/4W
R13,R15,R20, R31,R34,R39	RCR07G202J	81349	RES., 2K±5%, 1/4W
R14	104766-G2	23207	RES., 1 Ohm±1%, 3W
R17	RCR07G132J	81349	RES., 1.3K±5%, 1/4W
R18,R28	104700-G3	23207	RES. VAR., 1K±10%, 1/2W
R19	RCR07G472J	81349	RES., 4.7K±5%, 1/4W
R21	RCR07G513J	81349	RES., 51K±5%, 1/4W
R22	RCR07G512J	81349	RES., 5.1K±5%, 1/4W
R23	RCR07G271J	81349	RES., 270 Ohm±5%, 1/4W
R24	RCR07G104J	81349	RES., 100K±5%, 1/4W
R26	RCR076621	81349	RES., 620 Ohm±5%, 1/4W
R27	RN55C3011F	81349	RES., 3.01K 1%, 1/10W
R29	RN55C6041F	81349	RES., 6.04K 1%, 1/10W
R30	RCR07G103J	81349	RES., 10K±5%, 1/4W
R32	RCR07G471J	81349	RES., 470 Ohm±5%, 1/4W
R35	104701-G7	23207	RES. VAR., 5K±10%, 1/2W
R36	RN55C1212F	81349	RES., 12.1K±1%, 1/10W

REPLACEMENT PARTS LIST (Cont'd)

MAIN PROCESSOR A2 P/N 110356 (Cont'd)

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
R37	RN55C1211F	81349	RES., 1.21K±1%, 1/10W
R40,R41	RCR07G100J	81349	RES., 10 Ohm±5%, 1/4W
RN1	104799-G1	23207	RES. NETWORK, 51K
S1	104851	23207	SWITCH, ROTARY
[illegible]	104816-G2	23207	SWITCH, MOMENT. P.B.
	104640	23207	TRANSFORMER
U1	104250	23207	IC, CMOS COUNTER
U2	104239-G1	23207	IC, MICROPROCESSOR
U3	104235	23207	IC, CMOS RAM
U5	104225-G7	23207	IC, OCTAL LATCH
U6-U11	105910	23207	IC, PROM
U12	104388-G2	23207	IC, DECODER
U13	104231-G6	23207	IC, 4 INPUT NAND
[illegible]14,U27-U31	104202-G3	23207	IC, QUAD LATCH
U15	104204-G6	23207	IC, 3 INPUT OR
U16	104388-G1	23207	IC, DECODER
U17	104231-G1	23207	IC, HEX INVERTER
U18	104201-G1	23207	IC, DUAL F-F
U19	104387-G1	23207	IC, BUFFERS
U20,U21	104225-G2	23207	IC, HEX LATCH

REPLACEABLE PARTS LIST (Cont'd)

MAIN PROCESSOR BOARD A2 P/N 110356 (Cont'd)

REF. DESIG.	PART NO.	MAN. CODE	DESCRIPTION
U22-U26	104222-G4	23207	IC, DRIVER
U32	104223-G1	23207	IC, OP AMP
U33	104321	23207	IC, SW. REG.
U34	104209	23207	IC, -12V REG.
U35	104253-G1	23207	IC, +12V REG.
Y1	107546-G1	23207	CRYSTAL 32.768KHZ
Y2	107454	23207	CRYSTAL 5.0688MHZ
XU3,XU6-U11	104933	23207	SOCKET 24 PIN
XU2	104935	23207	SOCKET 40 PIN

REPLACEABLE PARTS LIST

ANALOG BOARD A3 P/N 110362-G1, G2

REF. DESIG.	PART NO.	MAN CODE NO.	DESCRIPTION
C1,C2,C4	104017-G2	23207	CAP, 27pf±5%, 500V
C3,C15	104026-G4	23207	CAP, 10pf±1/2pf, 500V
C6, C7, C16-C24 C28-C54	103208-G4	23207	CAP, .1µf±20%, 50V
C8,C9	104076-G2	23207	CAP, 4700pf±10%
C10	104076-G1	23207	CAP, 3300pf±10%
	104017-G1	23207	CAP, 22pf±5%, 500V
C13, C14, C27	103209-G2	23207	CAP, .22µf±20%, 50V
C25,C26	104016-G4	23207	CAP, 20pf±5%, 500V
CR1,CR2	102899	23207	DIODE
CR3-CR17	104412-G2	23207	DIODE
J1	207158-2	00779	6 Pin Header
J2,J3,J4	9-350258-1	00779	6 Pin Header
J5	102160-8, 102312-2 *	00779	34 Pin Rt. Angle Header + Latch
J6	87543-5 2-530153-2	00779	10 Pin Header + Strap
K1,K2	110751-G1*	23207	Reed Relays
R5,R12,R19	101791-G1	23207	RES VAR 2K±10% 1/2W
R6,R13,R20,R27, R28,R34,R35,R41, R42,R62	104701-G7	23207	RES. VAR. 5K±10%, 1/2W

*G2 Only

REPLACEABLE PARTS LIST (Cont'd)

ANALOG BOARD A3 P/N 110362-G1 (Cont'd)

REF. DESIGN.	PART NO.	MAN CODE NO.	DESCRIPTION
R7,R14,$21,R26, R29,R33,R36,R40 R43,R63	RN55C9762F	81349	RES. 97.6K±1%, 1/10W
R22-R25,R30-R32, R37-R39,R44,R65	RN55C1003F	81349	RES. 100K±1%, 1/10W
R45	RN55C8062F	81349	RES. 80.6K±1%, 1/10W
R46,R50	RN55E1003B	81349	RES. 100K±.1%, 1/10W
R47,R52	RN553012C	81349	RES. 30.1K±.1%, 1/10W
R48,R51	RN55C8252C	81349	RES. 82.5K±.25%, 1/10W
R49	RN55C1274C	81349	RES. 1.27M±.25%, 1/10W
R53	RN55C1182C	81349	RES. 11.8K±.25%, 1/10W
R54	RN55C1822F	81349	RES. 18.2K±1%, 1/10W
R55	104700-G3	23207	RES. VAR. 1K±10%, 1/2W
R56,R58	RN55C1002F	81349	RES. 10K±1%, 1/10W
R57	RN55C2001F	81349	RES. 2K±1%, 1/10W
R59	RN55C9761F	81349	RES. 9.76K±1%, 1/10W
R60	104701-G6	23207	RES. VAR. 500K±10%, 1/10W
R61,R68, R70,R76	RCR07G202J	81349	RES. 2K±5%, 1/4W
R64	RN55C6342F	81349	RES. 63.4±1%, 1/10W
R66	104700-G4	23207	RES. VAR. 10K±10%, 1/2W
R67	RCR07G104J	81349	RES. 100K±5%, 1/4W

*G2 Only

REPLACEABLE PARTS LIST (Cont'd)

ANALOG BOARD A3 P/N 110362-G1, G2 (Cont'd)

REF. DESIGN.	PART NO.	MAN. CODE NO.	DESCRIPTION
R69,R71,R77	RCR07G102J	81349	RES. 1K±5%, 1/4W
R72,R75,R78	RCR07G204J	81349	RES. 200K±5%, 1/4W
R73,R74,R79,	RCR07G303J	81349	RES. 30K±5%, 1/4W
R80	RCR07G106J	81349	RES. 10M±5%, 1/4W
R81	RN558662C	81349	RES. 86.6K±.25%, 1/10W
R82,R84	RN55C4753C	81349	RES. 475K±.25%, 1/10W
R83,R85	RN55C3243C	81349	RES. 324K±.25%, 1/10W
R86	RN55C5111F	81349	RES. 5.11K±1%, 1/10W
R88	RN55C2002F	81349	RES. 20K±1%, 1/10W
RN1	104799-G2	23207	RES. NETWORK 100K±2%
RN2-RN4	104740	23207	RES NETWORK
TB1,TB2	104205-NL	52458	5 POS. TERMINAL BLOCK
U1-U4	104276-G1	23207	IC OP AMP
U5,U6,U9 U11,U12	104255-G1	23207	IC QUAD ANALOG SWITCH
U7,U13	104236-G2	23207	IC OP AMP
U8,U10,U14	104256-G2	23207	IC SAMPLE/HOLD
U15,U16,U18	104256-G1	23207	IC OP AMP
U17	104201-G1	23207	IC COMPARATOR
U19	104257-G1	23207	IC DUAL F/F

REPLACEABLE PARTS (Cont'd)

ANALOG BOARD A3 P/N 110362-G1, G2 (Cont'd)

REF. DESIG.	PART NO.	MAN. CODE NO.	DESCRIPTION
U20	104258-G1	23207	IC, DAC
U21	104259-G1	23207	IC, CMOS SAR
U22,U23, U41-U43	104387-G1	23207	IC, TRI-STATE BUFFER
U24-U29, U31	104202-G3	23207	IC, QUAD. LATCH
U30	104222-G4	23207	IC. DRIVER
U32,U33,U34	104333	23207	IC, OPTO COUPLER
U34	104200-G5	23207	IC, QUAD NAND
U36	104217-G2	23207	IC, DUAL COUNTER
U37	105910	23207	IC, PROM
U39	104225-G7	23207	IC, OCTAL LATCH
U40	104388-G1	23207	IC, DECODER
U44	104239-G1	23207	IC, MICROPROCESSOR
U45	104231-G2	23207	IC, QUAD. NAND
U46	104384-G2	23207	IC, VOLT. REG.
Y1	107454	23207	5.0688MHz CRYSTAL
XU1-XU4, XU7-XU13	104927	23207	8 PIN SOCKET
XU20	110749	23207	16 PIN SOCKET
XU21,XU37	104933	23207	24 PIN SOCKET
XU44	104935	23207	40 PIN SOCKET
XK1,XK2	104928	23207	14 PIN SOCKET

REPLACEABLE PARTS LIST

TRANSFORMER BOARD A4 P/N 110368-G1, G3

REF. DESIGN	PART NO.	MAN. CODE.	DESCRIPTION
T1	104639	23207	TRANSFORMER

REPLACEABLE PARTS LIST

PRINTER ASSY. A5 P/N 110345-G1, G2

REF. DESIGN	PART NO.	MAN. CODE	DESCRIPTION
A1	110600	23207	FLEX CABLE ASSY.
	110341	23207	HARNESS
	110311*	23207	PRINTER DOOR
	110313*	23207	PRINTER MOUNTING PLATE
	110314	23207	MOTOR SUPPORT BRKT.
	110315	23207	MOTOR ARM
	103624	23207	PLATEN
	110317	23207	PANEL STIFFENER
	110318	23207	TORSION RING
	110320	23207	PAPER SPOOL SUPPORT
	110321	23207	SPOOL SPRING

*G2 Only

REPLACEABLE PARTS LIST (Cont'd)

PRINTER ASSY. A5 P/N 110345-G1, G2 (Cont'd)

REF. DESIGN	PART NO.	MAN. CODE	DESCRIPTION
	110323	23207	PRINTER + SWITCH BRACKET
	110324	23207	PRINTER + MOTOR BRACKET
	103640*	23207	HINGE
	103622	23207	PRESSURE CLAMP
	110605*	23207	PRINTER SHIM
	103641	23207	SPRING PAPER HOLDER
	103625	23207	PRINTHEAD SHAFT
	103626	23207	PRINTER ROLLER SHAFT
	103628-G2	23207	PRINTER LEFT SPRING
	103627-G2	23207	PRINTER RIGHT SPRING
B1	103699	23207	STEPPING MOTOR ASSY.
	103631	23207	PINCH ROLLER
	103604	23207	THERMAL PRINTHEAD
	103633	23207	PRINTHEAD SUBSTRATE SUPPORT
	110374	23207	PAPER GUIDE
	110332*	23207	PRINTER DOOR OVERLAY
B2	RS365-1885		DC MOTOR
P2	640442-4	00779	CONNECTOR
S1	104845	23207	LOW TORQUE SWITCH
	HN3G-34-1*	83014	GROMMET

*G2 ONLY

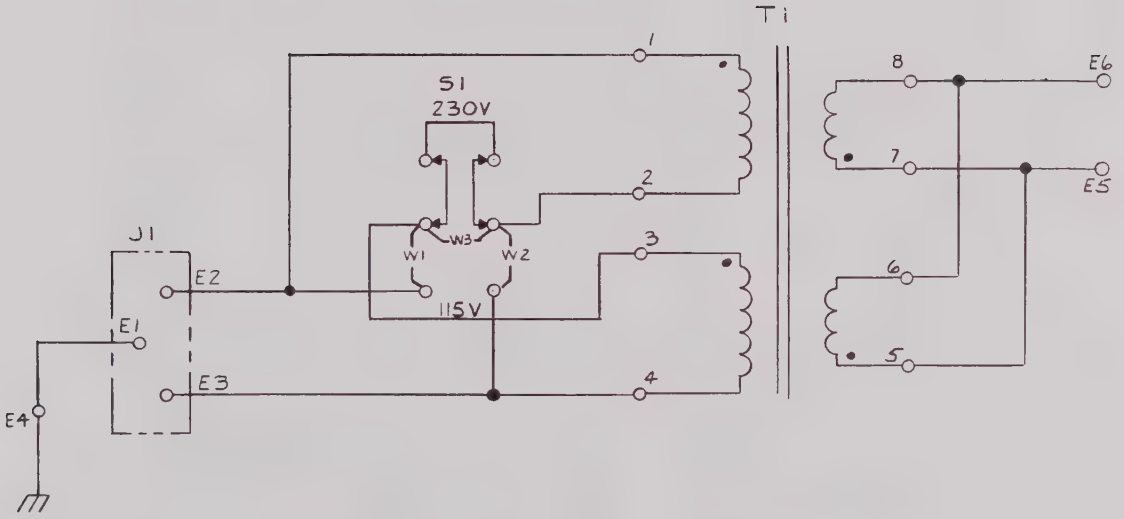
REPLACEABLE PARTS LIST (Cont'd)

PRINTER ASSY. A5 P/N 110345-G1, G2 (Cont'd)

REF. DESIGN	PART NO.	MAN. CODE	DESCRIPTION
	HN3P-34-1*	83014	PLUNGER
	110319-G1**	23207	PAPER SPOOL
	110707-G1**	23207	PULLEY
	107542-G1**	23207	"O" RING
	110319-G2***	23207	PAPER SPOOL
	110707-G2***	23207	PULLEY
	107542-G2***	23207	"O" RING
	110604	23207	GROOVED PIN S/M
	107487	23207	NYLON BUSHING
	PS094032	62806	PUSH ON FASTENER
	110645	23207	MOTOR DAMPER BRKT.

*G2 ONLY
INTERCHANGEABLE WITH * SET OF PARTS

10	DIAGRAMS
10-1	KEYBOARD/DISPLAY 110350 SCHEMATIC DIAGRAM
10-2	MAIN PROCESSOR BOARD 110356 SCHEMATIC DIAGRAM
10-3	ANALOG BOARD 110362-G1,G2 SCHEMATIC DIAGRAM
10-4	TRANSFORMER BOARD 110368-G1,G3 SCHEMATIC DIAGRAM
10-5	PRINTER ASSY. 110345-G1,G2 DIAGRAM
10-6	MAINFARME 110300-G1,G2 ASSEMBLY
10-7	808 INTERCONNECTION DIAGRAM
10-8	KEYBOARD/DISPLAY 110350 PARTS PLACEMENT
10-9	MAIN PROCESSOR BOARD 110356 PARTS PLACEMENT
10-10	ANALOG BOARD 110362-G1,G2 PARTS PLACEMENT
10-11	TRANSFORMER BOARD PARTS PLACEMENT



"G" LEVEL CHART	
	USED
110373-G1	T1, W1, W2
110373-G2	J1, S1, T1
110373-G3	T1, W3

FIGURE 10-4 TRANSFORMER BOARD 110368-G1,G3 SCHEMATIC

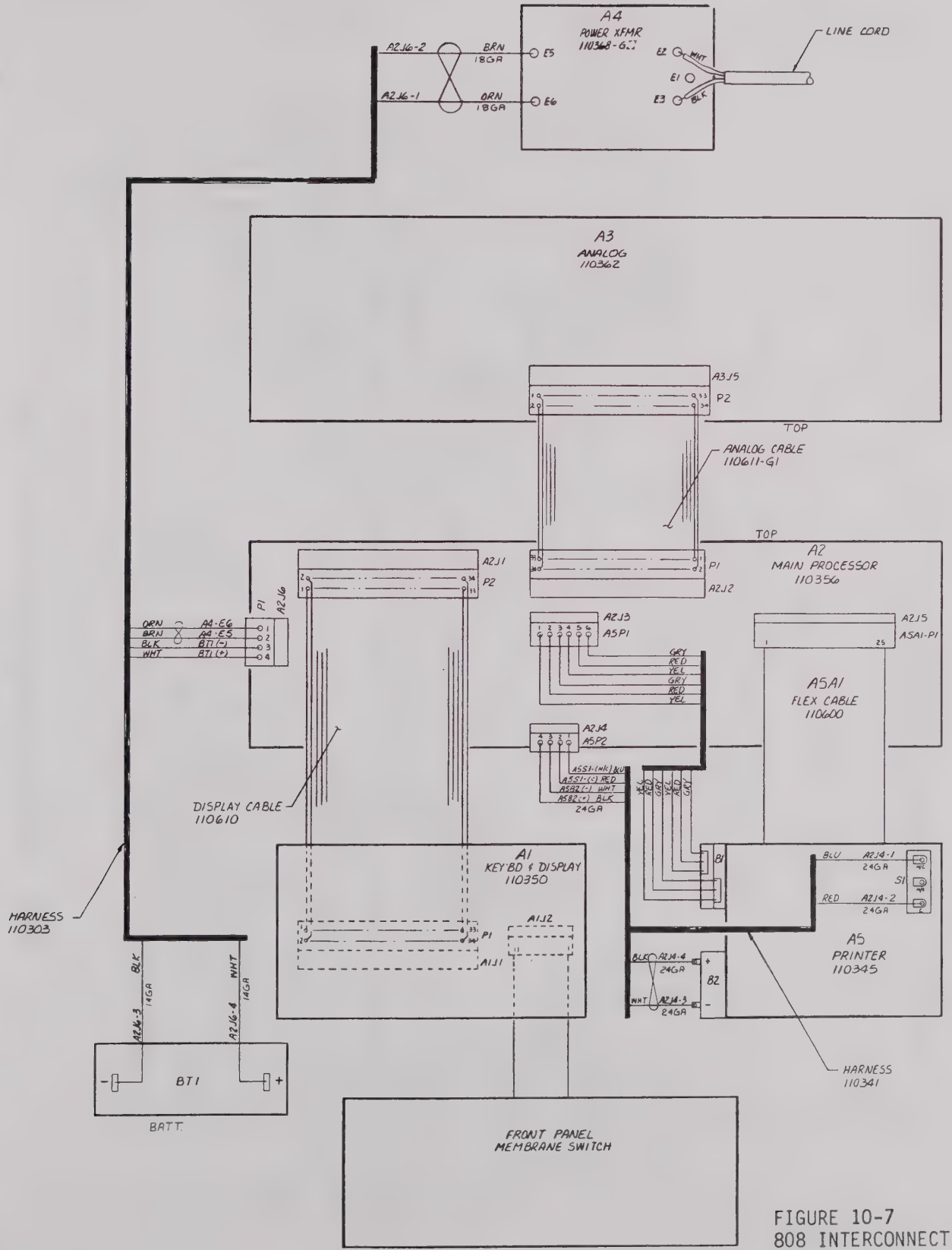


FIGURE 10-7
808 INTERCONNECTION
DIAGRAM

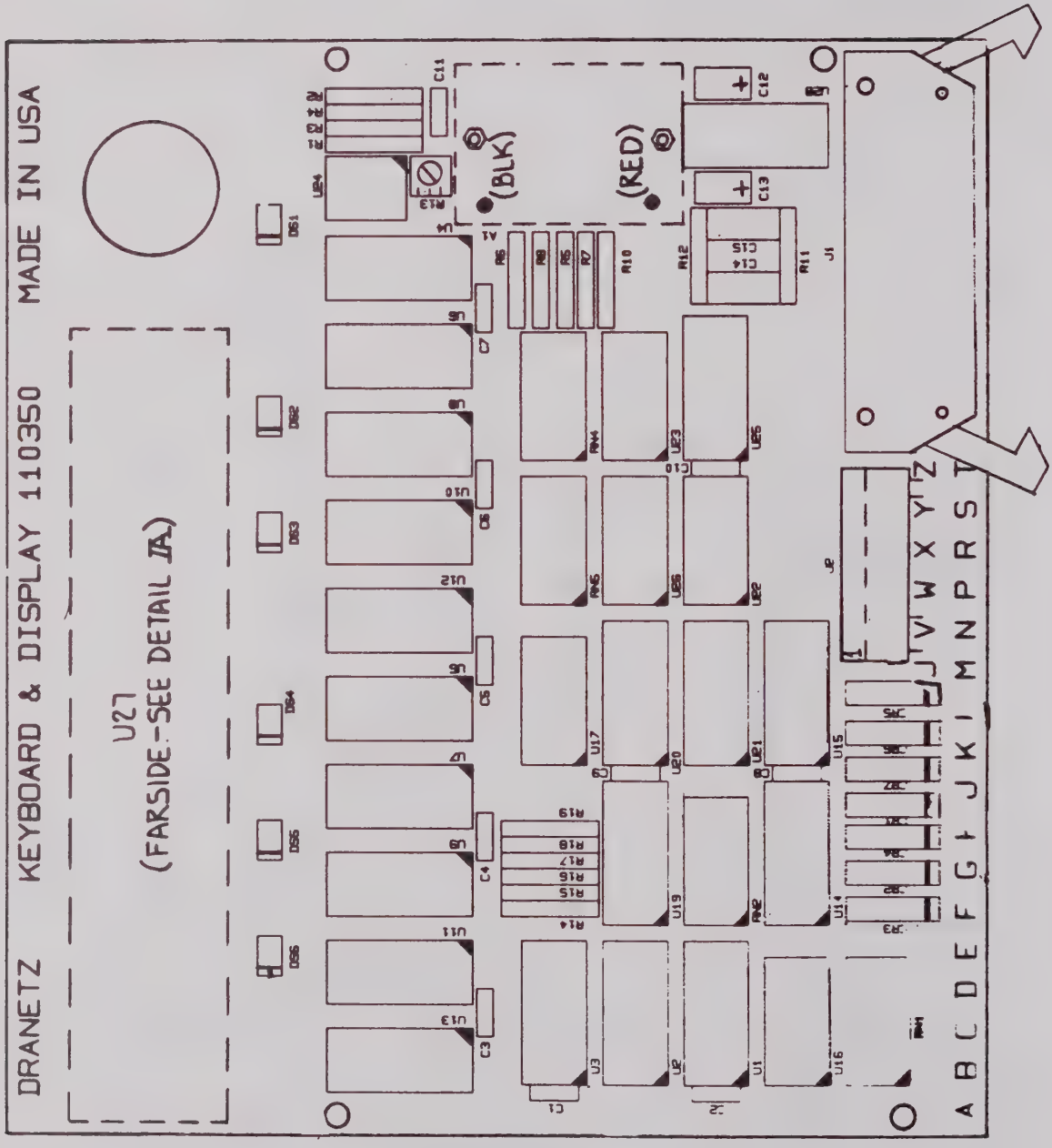


FIGURE 10-8 PARTS PLACEMENT KEYBOARD/DISPLAY 110350

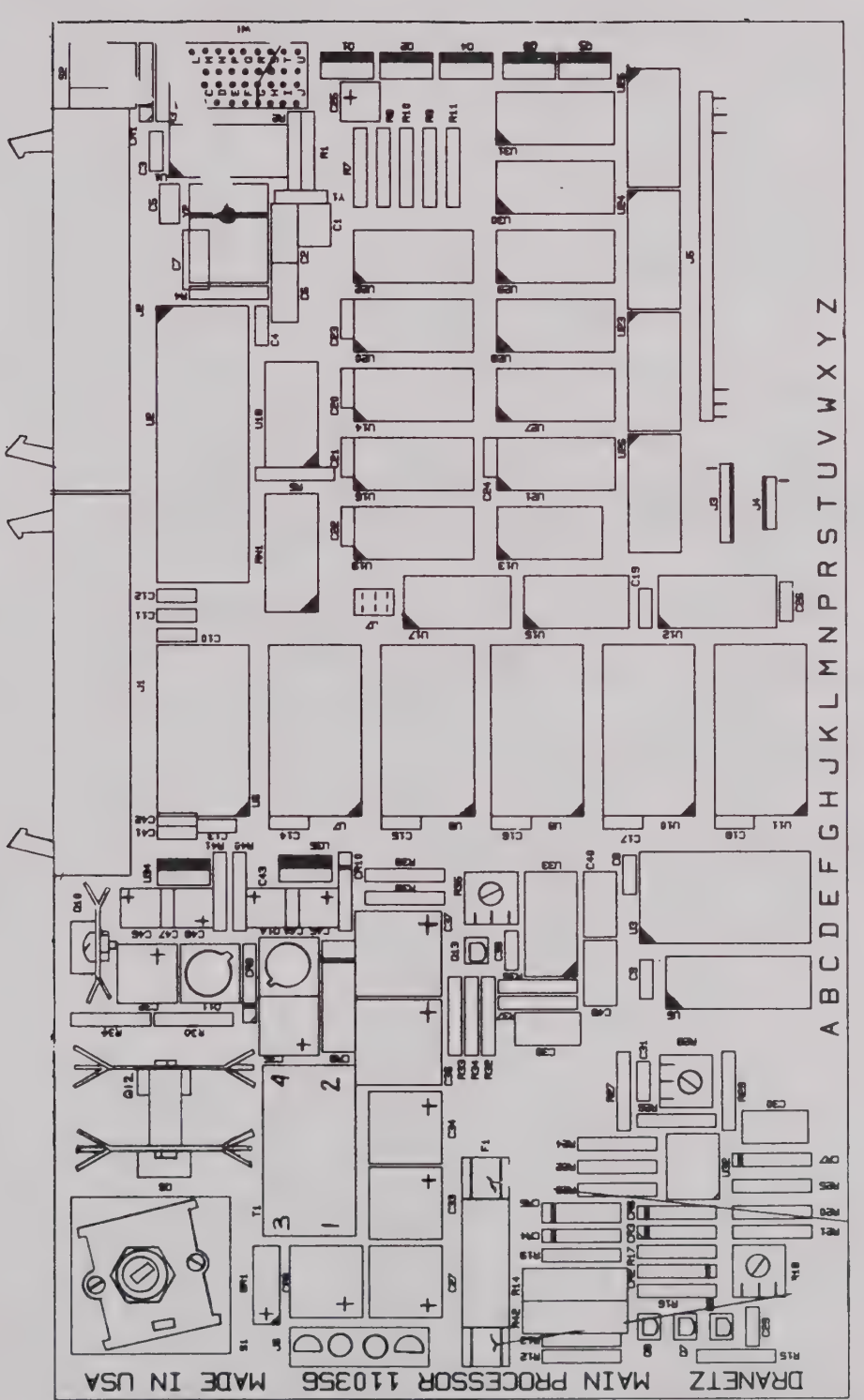


FIGURE 10-9 PARTS PLACEMENT MAIN PROCESSOR BOARD 110356

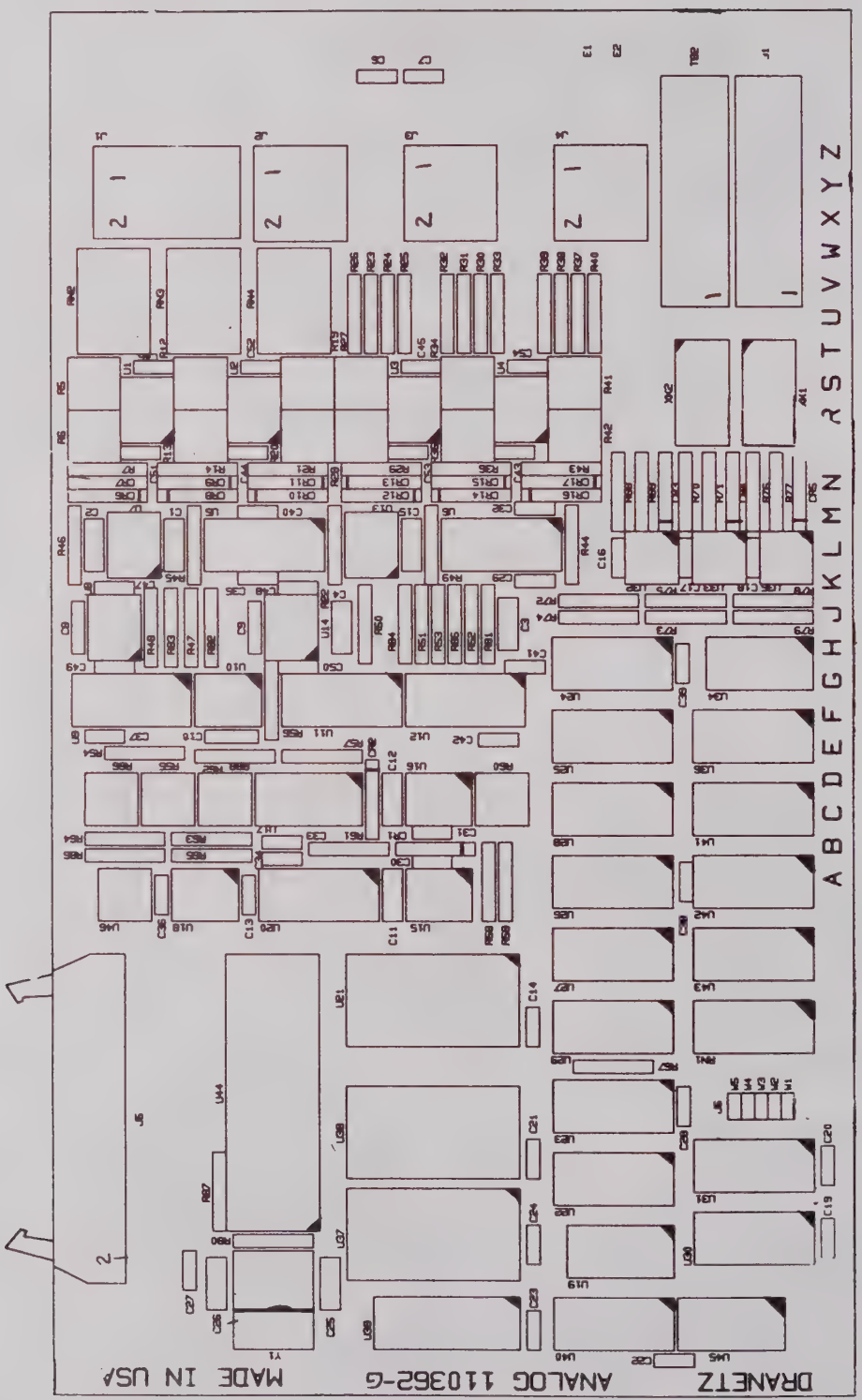
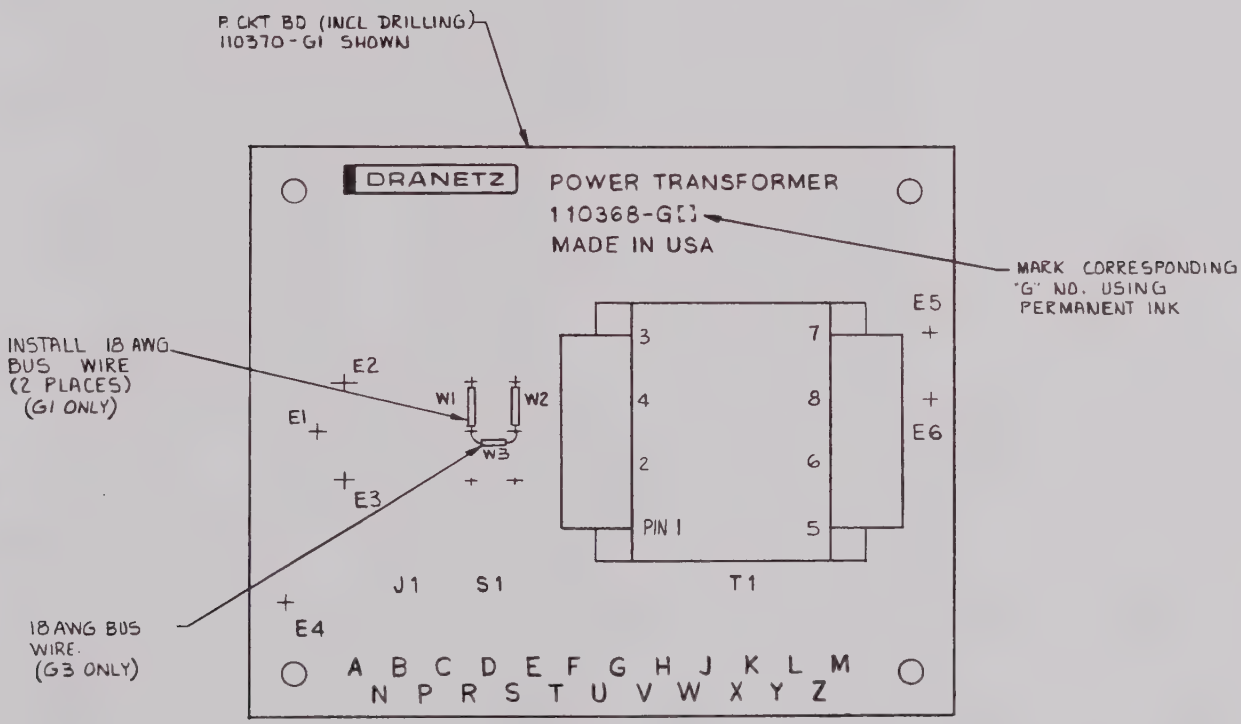
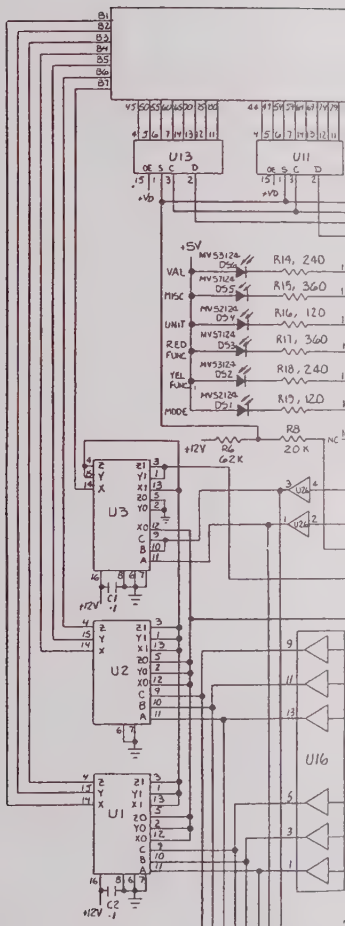


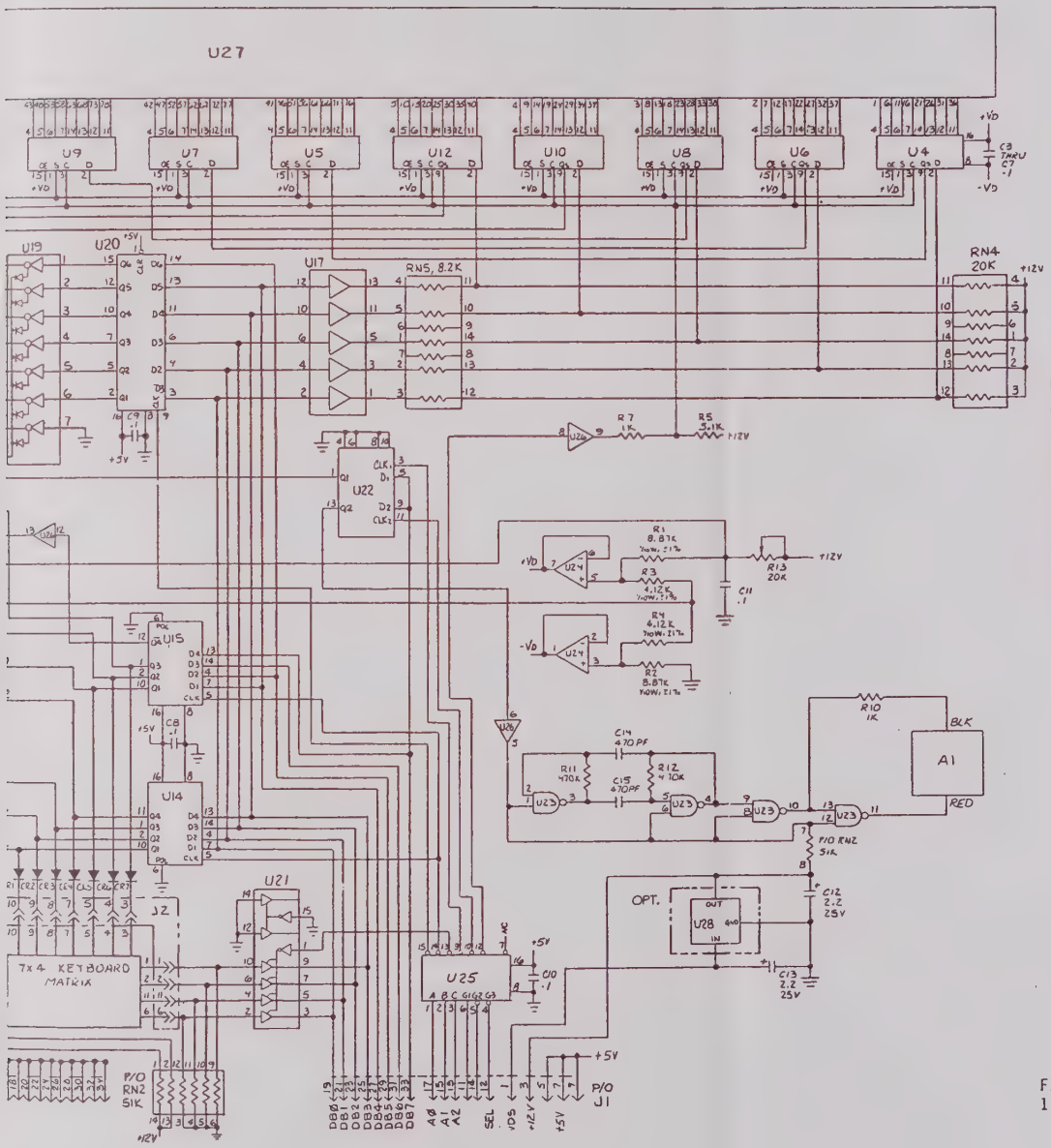
FIGURE 10-10 PARTS PLACEMENT ANALOG BD. 110362-G1,G2



-G1, -G3 VERSION

FIGURE 10-11 PARTS PLACEMENT TRANSFORMER BOARD 110368-G1,G3


U13
U11
+5V
VAL
MISC
UNIT
RED FUNC
YEL FUNC
MODE
R14, 240
R15, 360
R16, 120
R17, 360
R18, 240
R19, 120
R8
20K
+12V
R6
62K
U3
U2
U1
U16
C1
.1
C2
.1
RN1
91K
P/O J1



I.C. CHART					
REF. DESIG	DESCRIPTION	+5V	+12V	GND	-V
U1,2,3	CD4053		16	8	
U4-U13	CD4094				16
U14,U15	CD4042	16		8	
U16,U17,U26	MM74C906N	14		7	
U19	SN75468N			8	
U20	MM74C174N	16		8	
U21	MM80C97N	16		8	
U22	CD4013	14		7	
U23	CD4011		14	7	
U24	TL062ACP		8	4	
U25	MD74SC138AE	16		8	
U27	GE94E3R326				
U28	UA78I2C				

NOTES:
UNLESS OTHERWISE SPECIFIED
1. ALL RESISTOR VALUES ARE ¼W. ±5%
2. ALL CAPACITOR VALUES ARE IN MICROFAR
3 ALL DIODES ARE IN4148

SPARES

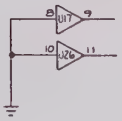
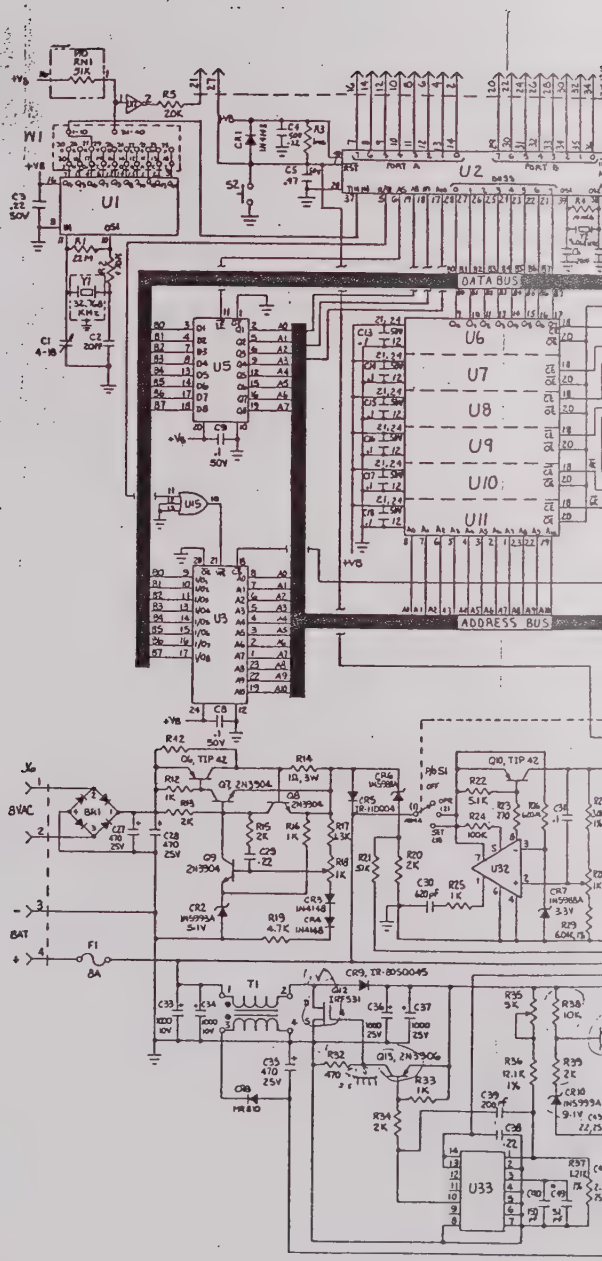
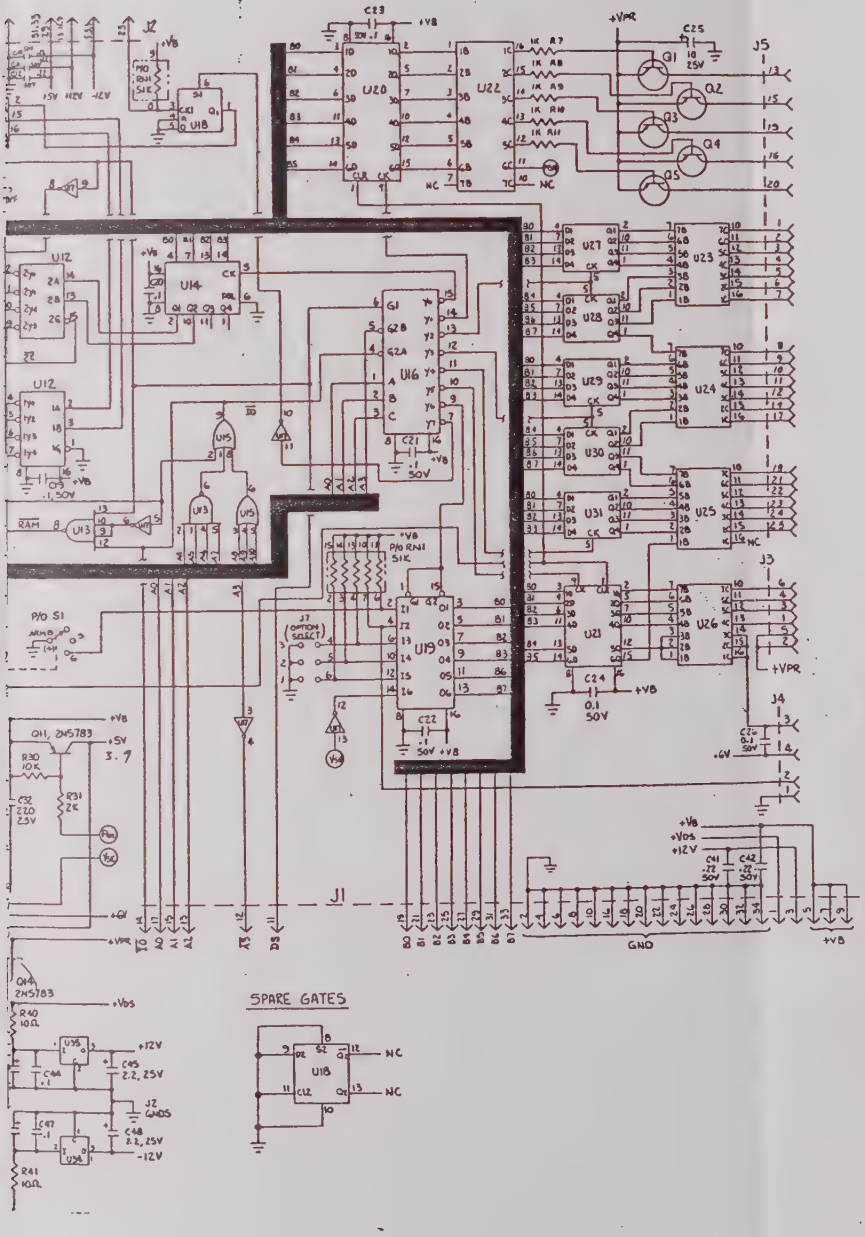


FIGURE 10-1 KEYBOARD/DISPLAY
110350 SCHEMATIC DIAGRAM


DATA BUS
ADDRESS BUS
U1
U2
U3
U5
U6
U7
U8
U9
U10
U11
U32
U33
8VAC
BAT
8A
T1



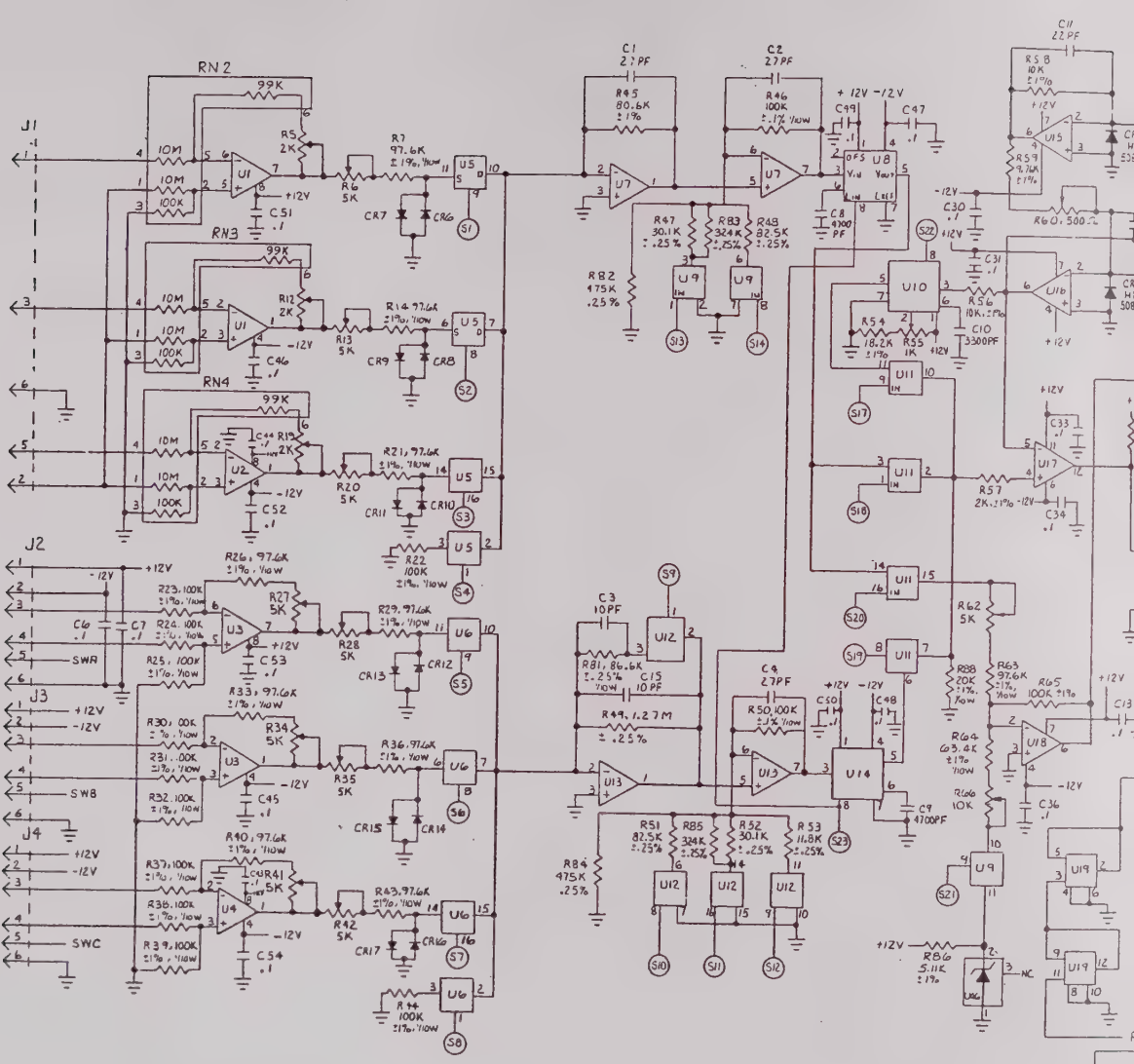
NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   - A. RESISTOR VALUES ARE 1/4W. ± 5%
   - B. CAPACITOR VALUES ARE IN MICROFARA
   - C. TRANSISTORS ARE TIP-125.
2. * SELECT AT TEST.

DESIG	TYPE	GND	+VB	+12V	+VPR	+6V
U1	CD4060BE	8,12	16			
U2	MC14536BCP	20	40			
U3	MM6116LP-4	12	24			
U5	74C373	1,10	20			
U6,7,8,9,10,11	27C16	12	21,24			
U12	74SC139N	1,8	16			
U13	MM74C20N	7	14			
U14	CD4042BE	6,8	16			
U16	74SC138	8	16			
U18	CD4013BE	4,5,7	14			
U19	MM80C97N	8	16			
U22,23,24,25,26	75468	8			9	
U27,28,29,30,31	CD4042BE	6,8	16			
U32	CA3094E	4,6				
U33	TL497ACN	2,4,5				14
U34	UA7912C	1				
U35	UA7812C	2		3		
U15	CD4015BE	7	14			
U17	MM74C04N	7	14			
U20,U21	74C174N	8	16			

OSC OUTPUT FREQUENCY		
Q4 2048HZ	Q8 128 HZ	Q12 8HZ
Q5 1024HZ	Q9 64 HZ	Q13 4HZ
Q6 512 HZ	Q10 32 HZ	Q14 2HZ
Q7 256HZ		

FIGURE 10-2 MAIN PROCESSOR 110356
SCHEMATIC DIAGRAM



I.C. TABLE

DESIG	TYPE	+12V	-12V	+5V	GND
U1-U4	LF442ACN	8	4	–	–
U5, U6, U9, U11, U12	HI3-201-5	13	4	–	5
U7, U13	TL062ACP	8	4	–	–
U8, U10, U14	LF398N	1	4	–	7
U15, U16, U18	LF356	7	4	–	–
U17	LM319	11	6	–	3, 8
U19	CD4013	–	–	14	7
U20	AD7533	14	–	–	3
U21	MM74C905	–	–	24	12
U22, U23	80C97	–	–	16	8
U24-U29	CD4042	–	–	16	8
U30	75468	9	–	–	8
U31	CD4042	–	–	16	8
U32, U33, U35,	MCT273	–	–	–	–
U34	CD4011	–	–	14	7
U36	MC14520	–	–	16	8
U38	27C16	–	–	24	12
U39	MM74C373	–	–	20	10
U40	74SC138	–	–	16	8
U41, U42, U43	80C97	–	–	16	8
U44	MC146805E2	–	–	40	20
U45	SN74C00	–	–	14	7
U46	LM329Z	–	–	–	–
U37	27C3	–	–	24	12

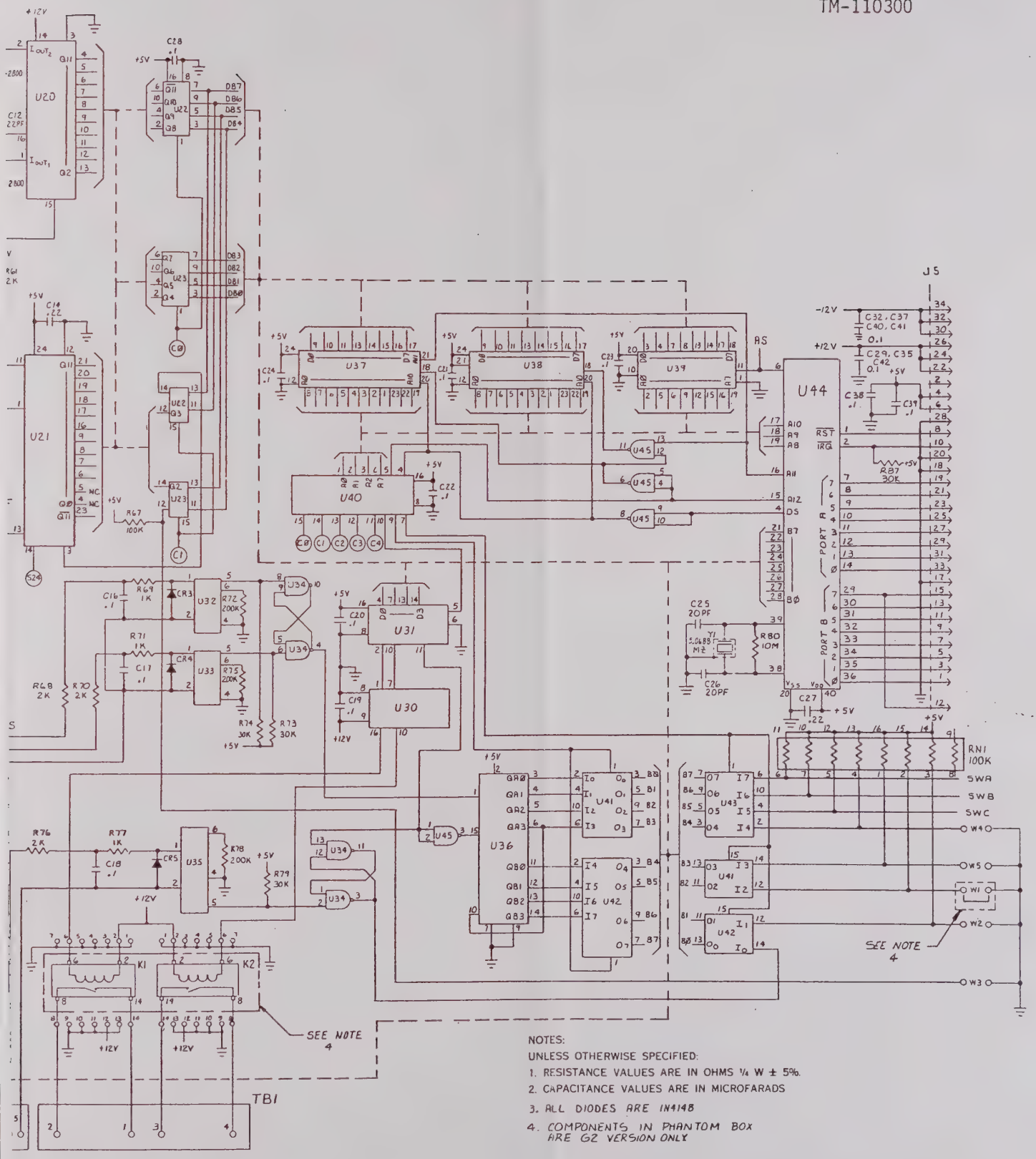
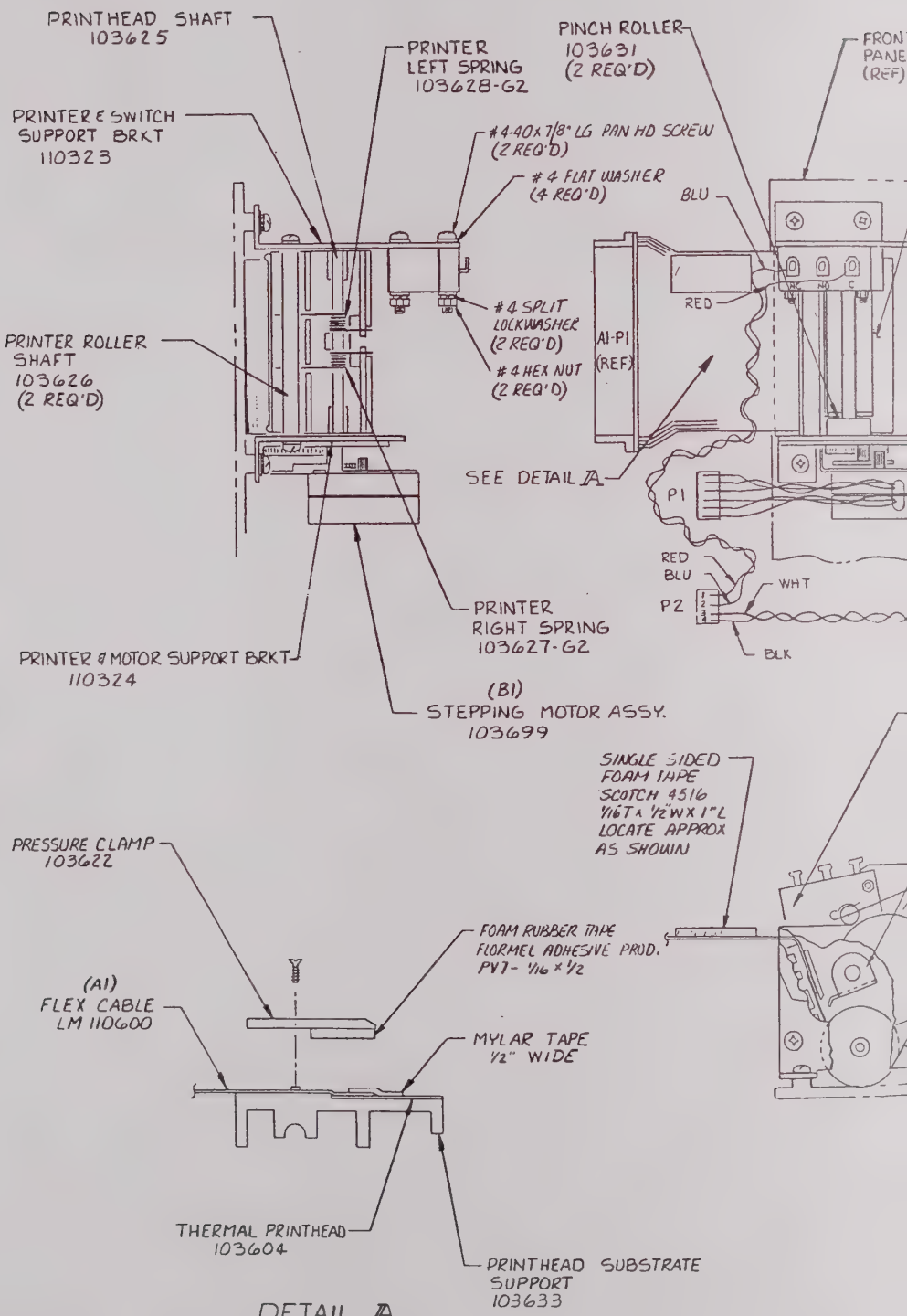


FIGURE 10-3 ANALOG BOARD 110362-G1,G2
SCHEMATIC DIAGRAM


PRINTHEAD SHAFT
103625
PRINTER
LEFT SPRING
103628-G2
PINCH ROLLER
103631
(2 REQ'D)
FRON
PANE
(REF)
PRINTER & SWITCH
SUPPORT BRKT
110323
#4-40 x 7/8" LG PAN HD SCREW
(2 REQ'D)
4 FLAT WASHER
(4 REQ'D)
BLU
4 SPLIT
LOCKWASHER
(2 REQ'D)
4 HEX NUT
(2 REQ'D)
RED
A1-P1
(REF)
PRINTER ROLLER
SHAFT
103626
(2 REQ'D)
SEE DETAIL A
P1
RED
BLU
WHT
P2
BLK
PRINTER
RIGHT SPRING
103627-G2
PRINTER & MOTOR SUPPORT BRKT
110324
(B1)
STEPPING MOTOR ASSY.
103699
SINGLE SIDED
FOAM TAPE
SCOTCH 4516
1/16T x 1/2"W x 1"L
LOCATE APPROX
AS SHOWN
PRESSURE CLAMP
103622
FOAM RUBBER TAPE
FLORMEL ADHESIVE PROD.
PV7- 1/16 x 1/2
(A1)
FLEX CABLE
LM 110600
MYLAR TAPE
1/2" WIDE
THERMAL PRINTHEAD
103604
PRINTHEAD SUBSTRATE
SUPPORT
103633

DETAIL A

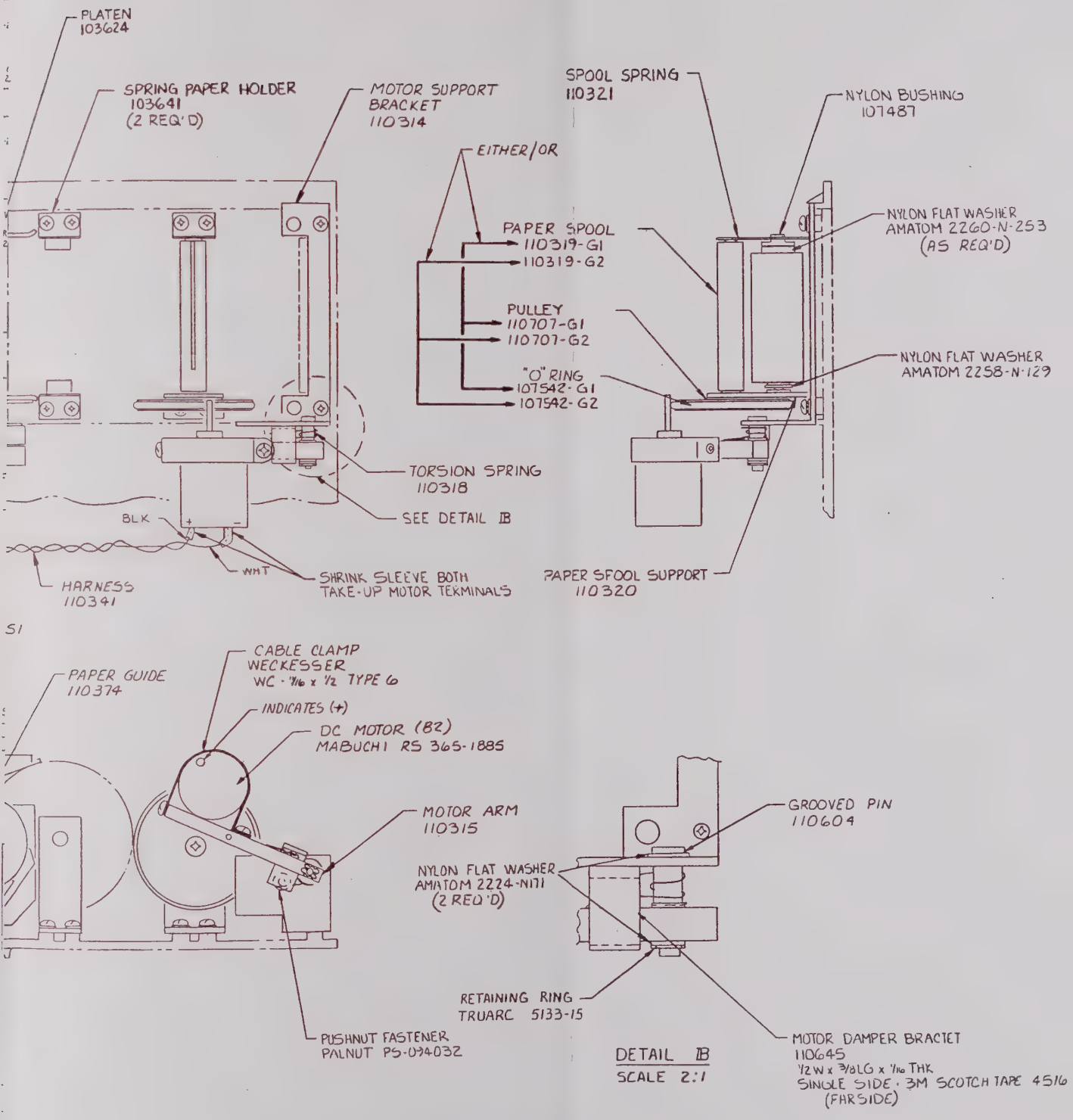
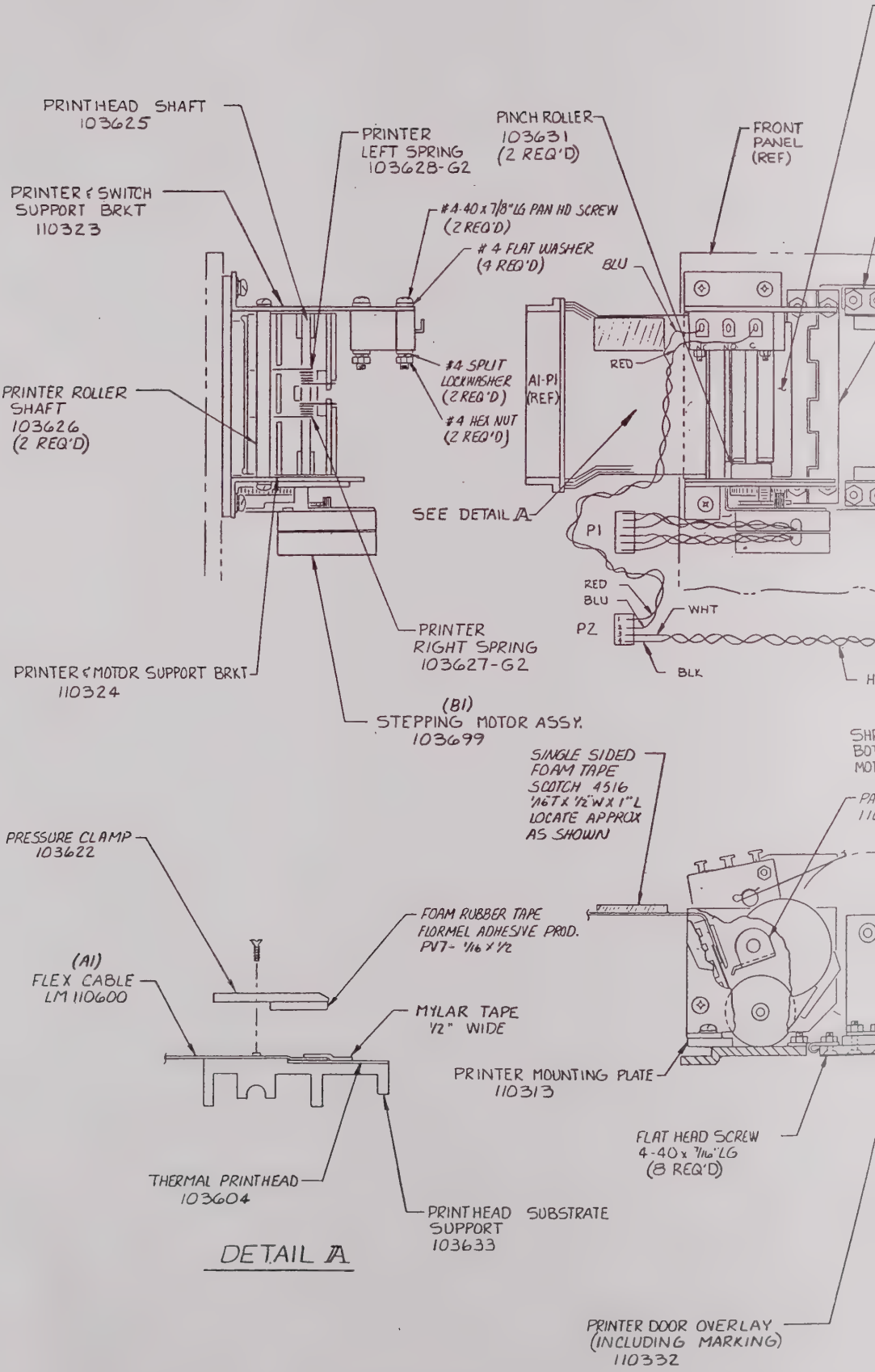


FIGURE 10-5A PRINTER ASSY. 110345-G1


PRINTHEAD SHAFT
103625
PRINTER
LEFT SPRING
103628-G2
PINCH ROLLER
103631
(2 REQ'D)
FRONT
PANEL
(REF)
PRINTER & SWITCH
SUPPORT BRKT
110323
#4-40 x 7/8" LG PAN HD SCREW
(2 REQ'D)
4 FLAT WASHER
(4 REQ'D)
BLU
#4 SPLIT
LOCKWASHER
(2 REQ'D)
#4 HEX NUT
(2 REQ'D)
A1-P1
(REF)
RED
PRINTER ROLLER
SHAFT
103626
(2 REQ'D)
SEE DETAIL A
P1
RED
BLU
WHT
P2
BLK
PRINTER
RIGHT SPRING
103627-G2
PRINTER & MOTOR SUPPORT BRKT
110324
(B1)
STEPPING MOTOR ASSY.
103699
SINGLE SIDED
FOAM TAPE
SCOTCH 4516
1/16T x 1/2"W x 1"L
LOCATE APPROX
AS SHOWN
PRESSURE CLAMP
103622
FOAM RUBBER TAPE
FLORMEL ADHESIVE PROD.
PV7- 1/16 x 1/2
(A1)
FLEX CABLE
LM 110600
MYLAR TAPE
1/2" WIDE
PRINTER MOUNTING PLATE
110313
FLAT HEAD SCREW
4-40 x 7/16" LG
(8 REQ'D)
THERMAL PRINTHEAD
103604
PRINTHEAD SUBSTRATE
SUPPORT
103633
DETAIL A
PRINTER DOOR OVERLAY
(INCLUDING MARKING)
110332

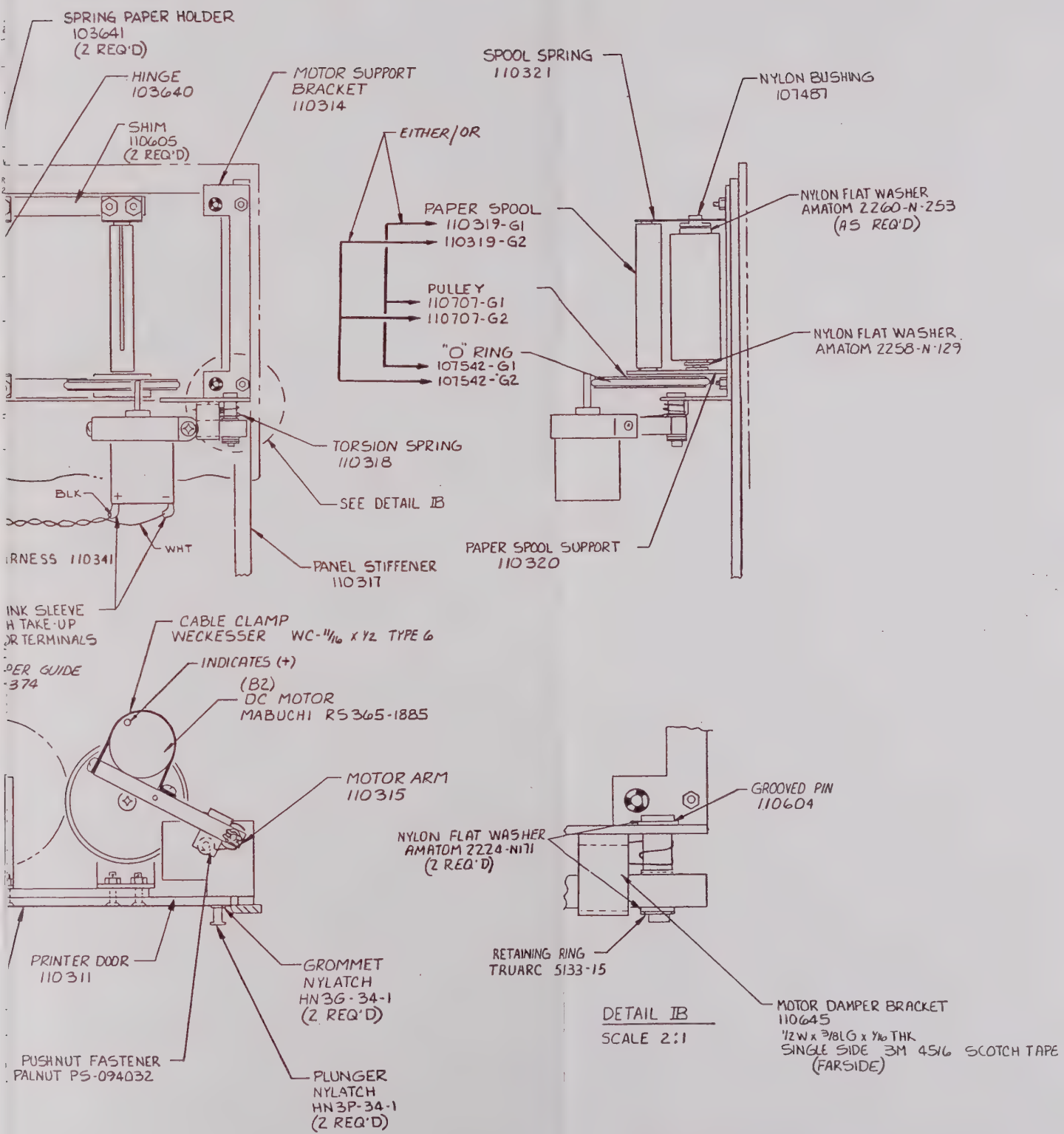
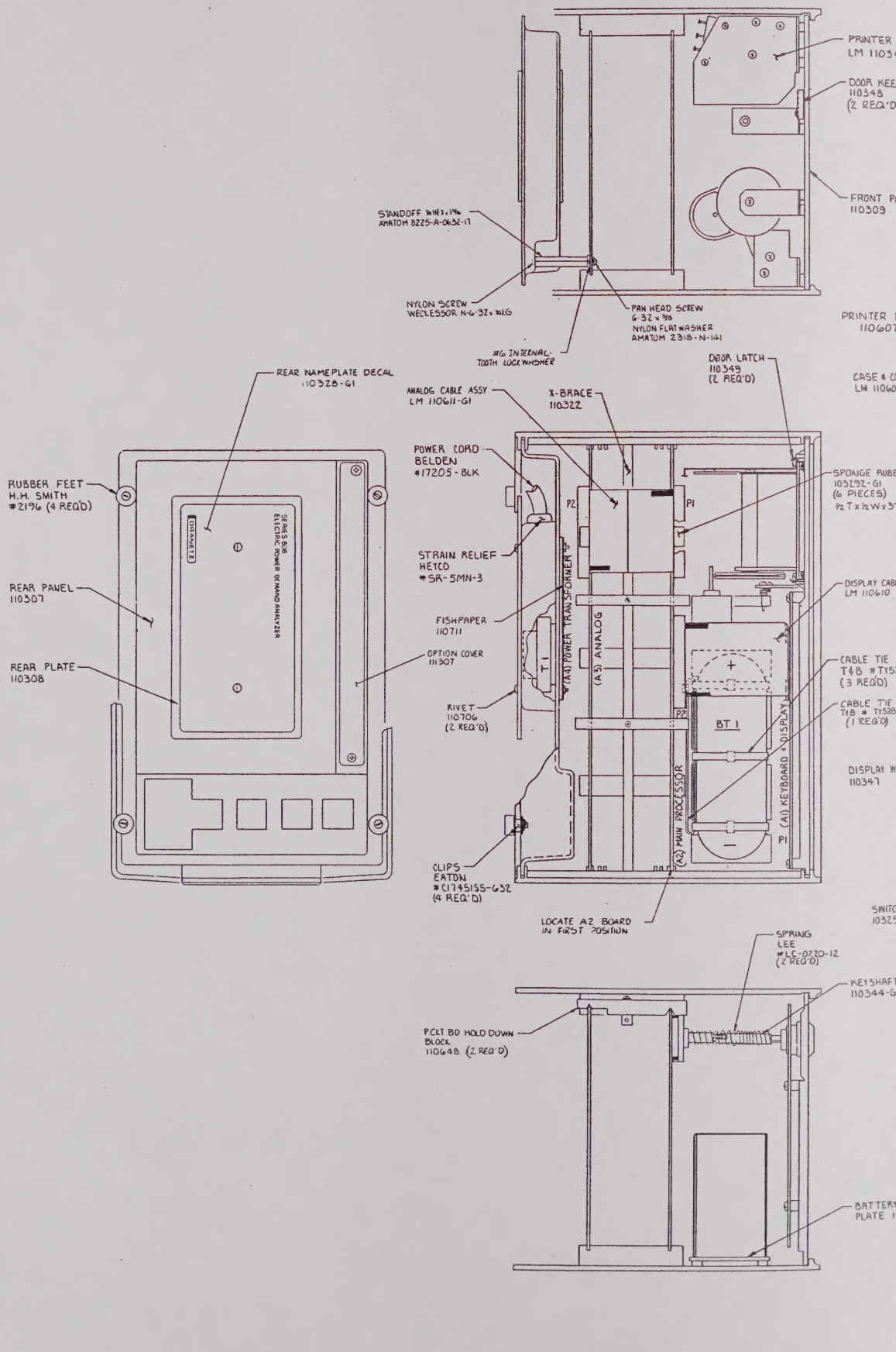
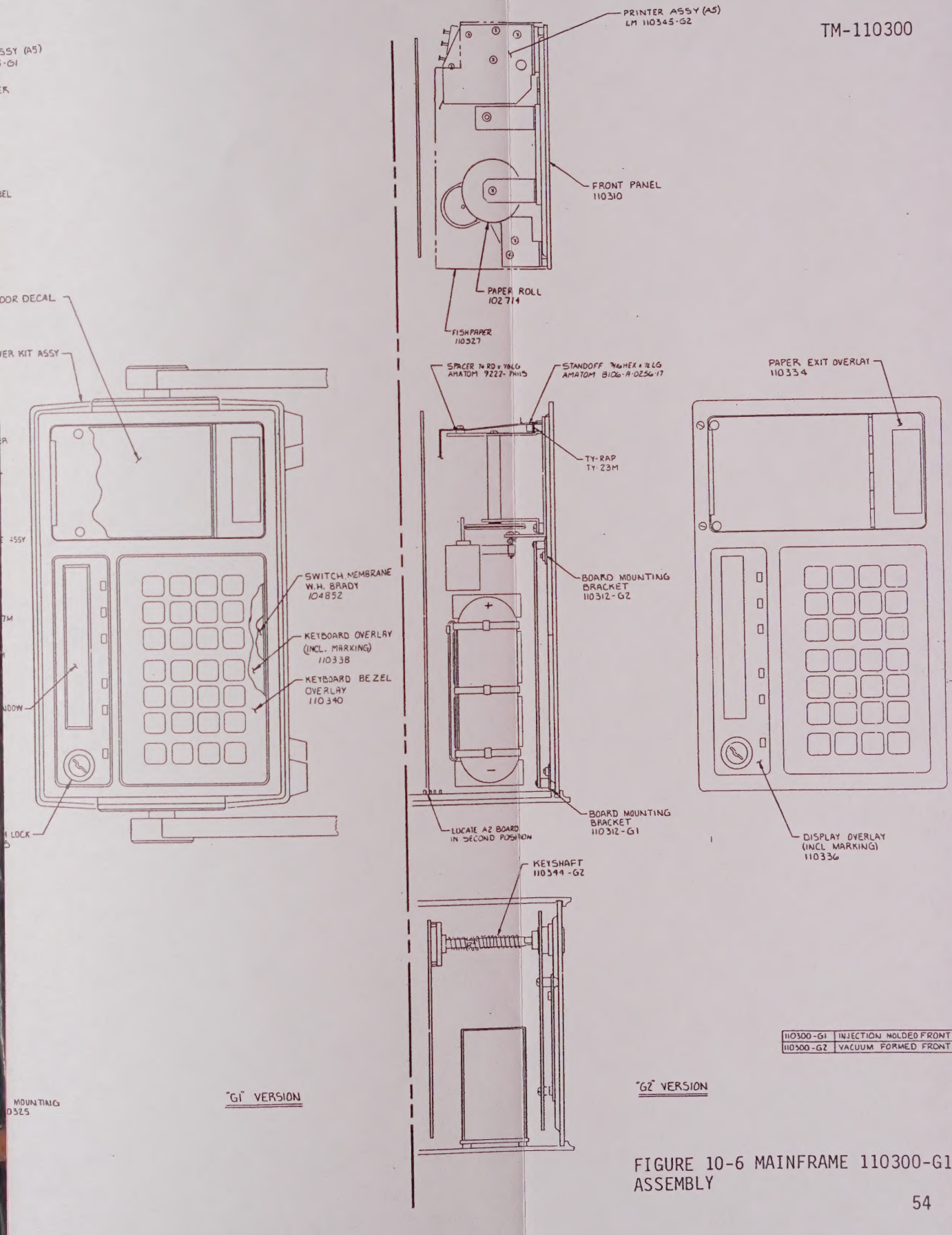


FIGURE 10-5B PRINTER ASSY. 110345-G2


PRINTER
LM 1103
DOOR KEE
110348
(2 REQ'D
FRONT P
110309
STANDOFF
AMATOM 8225-A-0632-17
NYLON SCREW
WECLESSOR N-6-32 x
PAN HEAD SCREW
6-32 x
NYLON FLAT WASHER
AMATOM 2318-N-141
#6 INTERNAL-
TOOTH LOCKWASHER
PRINTER
110607
DOOR LATCH
110349
(2 REQ'D)
CASE &
LM 1106
REAR NAMEPLATE DECAL
110328-G1
ANALOG CABLE ASSY
LM 110611-G1
X-BRACE
110322
POWER CORD
BELDEN
#17205 - BLK
SPONGE RUBB
103292-G1
(6 PIECES)
RUBBER FEET
H.H. SMITH
#2196 (4 REQ'D)
STRAIN RELIEF
HEYCO
#SR-5MN-3
P2
P1
REAR PANEL
110307
FISHPAPER
110711
DISPLAY CAB
LM 110610
OPTION COVER
111307
REAR PLATE
110308
RIVET
110706
(2 REQ'D)
CABLE TIE
T&B # TY52
(3 REQ'D)
CABLE TIE
T&B # TY52
(1 REQ'D)
DISPLAY W
110347
CLIPS
EATON
#C1745155-632
(4 REQ'D)
LOCATE A2 BOARD
IN FIRST POSITION
SPRING
LEE
#LC-0720-12
(2 REQ'D)
KEYSHAF
110344-G
PCKT BD HOLD DOWN
BLOCK
110648 (2 REQ'D)
BATTERY
PLATE



110300-G1	INJECTION MOLDED FRONT PANEL
110300-G2	VACUUM FORMED FRONT PANEL

FIGURE 10-6 MAINFRAME 110300-G1,G2 ASSEMBLY

MP MASTER
MA22987